(NASA-TM-85089) COMPARATIVE EVALUATION OF SPACE TRANSPORTATION SYSTEM (STS)-3 FLIGHT AND ACOUSTIC TEST RANDOM VIBRATION RESPONSE OF THE OSS-1 PAYLOAD (NASA) 185 p
HC A09/MF A01
N83-36054
CSCL 22B G3/16
Unclas
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NASA

Technical Memorandum 85089

COMPARATIVE EVALUATION OF SPACE TRANSPORTATION SYSTEM (STS)-3 FLIGHT AND ACOUSTIC TEST RANDOM VIBRATION RESPONSE OF THE OSS-1 PAYLOAD

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SEPTEMBER 1983

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PREFACE

This report presents a comparative evaluation of measured random vibration response data obtained from the Office of Space Science-1 (OSS-1) pallet payload. The data were measured during the acoustic test simulation (September 1980) and the ascent phase of the flight of Space Transportation System-3 (STS-3), Orbiter No. 102 (launched from the Kennedy Space Center (KSC) on March 22, 1982). The results provide greater insight into the characteristics of vibroacoustic response of pallet payload components in the payload bay during STS flights and are documented as part of the NASA DATE program activity.

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1.0 INTRODUCTION

This report presents a comparative evaluation of OSS-1 pallet payload (figures 1-3) random vibration response data obtained by the Dynamic, Acoustic and Thermal Environment (DATE) instrumentation during the Space Transportation System-3 (STS-3) flight and the NASA-Goddard Space Flight Center system level acoustic test of September 1980. The flight and acoustic test data required to perform this evaluation were acquired and produced as part of the DATE program activity. The data were obtained from twelve high frequency (5-2K Hz) accelerometers and five microphones at identical locations on the payload during the acoustic test and worst case flight event during the lift-off phase.

The acoustic test data contained in this evaluation correspond to the one test run (out of a total of six) selected to be the most appropriate for extrapolating to the STS-3 flight acoustic environment. This test run (run No. 6) was performed at an acoustic input level of 141.5dB in overall level with an 1/3 octave band acoustic spectrum profile similar to that of the "old" NASA/Johnson Space Center (JSC) Volumn XIV criteria. (Appendix A of this report contains a description of the acoustic test performed on the OSS-1 payload.) For correlation with flight measured data, the acoustic test vibration data are normalized to the STS-3 flight measured payload bay acoustic environment on the payload. The normalized data are termed "Extrapolated Test" throughout the report.

The extrapolated test vibration data are compared to the measured vibration response data obtained from the STS-3 flight in terms of the difference in 1/3 octave band acceleration levels (1/3 OBAL). This difference is defined as the "Test Efficiency Factor". In addition, a direct comparison is made of the 1/3 octave band acceleration spectral density levels (1/3 OBASDL). These comparative results are used as a basis for assessing the characteristics of the vibroacoustic response of pallet payload components in the payload bay during STS flights.

2.0 INSTRUMENTATION

The five microphones and twelve high frequency accelerometers on the OSS-1 pallet payload were selected, qualified, installed and calibrated by the Goddard Space Flight Center (GSFC). All the test data were recorded and reduced by the Environment Test and Integration Branch (Code 754) data acquisition/analysis system. The payload related random vibration data obtained during the STS-3 flight were acquired and reduced as part of the DATE Experiment activity, and are reported in Section 3 of DATE Report 004 (reference a).

Table 1 and figures 4-6 show the relative location of each DATE transducer on the OSS-1 pallet payload. The series of high frequency accelerometers measured the random vibration responses at selected experiment shelves and panels and at the base of selective instruments. Specific location, frequency range, axis, and orbiter coordinates for each transducer are given in table 1. Included also are the DATE microphones for reference purpose. As is illustrated, the series

of microphones measured the acoustic levels at various locations around the OSS-1 payload, such as, in the vicinity of the Thermal Canister Experiment (TCE), the experiment shelf on the forward starboard and aft port side of the payload, and on the forward center of the payload in the vicinity of the vertical shelf. One microphone measured the acoustic level transmitted to the inside of the TCE.

To confirm the location of each transducer, photographs were taken of each installation. All photographs are filed in the GSFC Mechanical Engineering Branch (Code 731) office. Several typical photos are included in figures 7-14. Figures 7-9 and 10-14, respectively, show typical microphone and accelerometer installations.

3.0 ACOUSTIC TEST DATA

3.1 Test Description

The system level acoustic test of the OSS-1 pallet payload was conducted in the 40,000 cubic foot acoustic noise test facility at the GSFC in September 1980. The pallet payload was suspended in the test chamber using a crane and pallet handling sling which interfaces with the pallet at the four trunnion fittings. A large dolly used in transporting the pallet payload remained in the acoustic chamber during the tests. For each test run, the pallet was lifted 4 to 5 feet from this dolly and then lowered back at the conclusion of

the run. Instrumentation included input control microphones, DATE microphones on the pallet payload, and strain gages on the Instrument Support Structure and numerous accelerometers (including twelve DATE accelerometers) on the pallet, structure, and instruments.

Input control microphones were positioned above the payload, one below the payload, and one at each of the four sides of the payload. The input test level was considered to be the average of these six microphone levels. The tests were run at six input levels from 130 to 141.5 dB in overall level. All of the data were recorded and most were reduced for all of the test runs.

3.2 Microphones

Acoustic data from the five DATE microphones are presented in appendix B in terms of 1/3 octave band sound pressure levels. The spatial average of the four DATE microphones (excluding the microphone inside the TCE) and the spatial average of the six non-DATE microphones used for control of the test chamber input acoustics are shown in figure B-6.

3.3 High Frequency Accelerometers

Random vibration response data from the twelve DATE high frequency accelerometers are shown in figures B-7 through B-18 in terms of narrow band (BW = 4 Hz) power spectral density in g^2/Hz.

3.4 Data Quality

Of the five DATE microphones and 12 high frequency vibration DATE accelerometers on the OSS-1 pallet payload, none exhibited problems during the system level acoustic test. The final assessment is that the instrumentation installed on the OSS-1 pallet payload as part of the DATE program gave acceptable data for the system level acoustic test.

4.0 EXTRAPOLATION OF TEST DATA

For correlation with flight measured data, the acoustic test random vibration data must be normalized to the STS-3 flight measured payload bay acoustic environment on the payload. The method used in this study to normalize or extrapolate the acoustic test data so as to be "equivalent" to the measured flight vibration data is described in the following paragraphs.

4.1 Extrapolation Method

Consider the acceleration spectral density response of an OSS-1 payload component to an acoustic test sound pressure of spectral density ($SPSD_{test}$) to be given by ASD_{test}. Under the assumption of vibration response linearity over acoustic test levels (see appendix C), the "equivalent" flight vibration response (ASD_{test}^{extrap}) resulting from the flight acoustic environment ($SPSD_{flight}$) can be extrapolated from the acoustic test data as follows:

$$ASD_{test}^{extrap} = (ASD_{test}/SPSD_{test}) \cdot SPSD_{flight} \qquad (1)$$

where ASD/SPSD is termed the transfer function between vibration response and acoustic input, and the ASD and SPSD are in consistent engineering units (e.g. g^2/Hz and psi^2/Hz).

For one-third octave band (1/3 OB) spectra,

$$1/3\ OBA = 1/3\ OBASD \cdot \Delta f$$

$$1/3\ OBSP = 1/3\ OBSPSD \cdot \Delta f \qquad (2)$$

where,

1/3 OBA = mean square acceleration (g^2) in one-third octave bandwidth

1/3 OBASD = acceleration spectral density (g^2/Hz) based on one-third octave bandwidth

1/3 OBSP = mean square pressure (psi^2) in one-third octave bandwidth

1/3 OBSPSD = sound pressure spectral density (psi^2/Hz) based on one-third octave bandwidth

Δf = one-third octave bandwidth (Hz)

It follows from (2) that (1) can be written as:

$$\text{extrap}\quad 1/3\ \text{OBA}_{test} = (1/3\ \text{OBA}_{test} \div 1/3\ \text{OBSP}_{test}) \cdot 1/3\ \text{OBSP}_{flight} \qquad (3)$$

In terms of dB units, (3) becomes:

$$\text{extrap}\quad 1/3\ \text{OBAL}_{test} = 1/3\ \text{OBAL}_{test} - 1/3\ \text{OBSPL}_{test} + 1/3\ \text{OBSPL}_{flight} \qquad (4)$$

where,

1/3 OBAL = one-third octave band level in dB reference to an assumed acceleration value (e.g. 2.9×10^{-9} grms, 1.0 grms, etc.)

1/3 OBSPL = one-third octave band level in dB reference to an assumed pressure value (e.g. 20 $\mu N/m^2$, 2.9×10^{-9} psi, etc.).

A reference acceleration value of 2.9×10^{-9} grms is numerically equivalent to the standard reference pressure value of 20 $\mu N/m^2$ or 2.9×10^{-9} psi.

Since (2) can be written in dB units as:

$$1/3\ \text{OBAL} = 1/3\ \text{OBASDL} + 10 \log \Delta f$$

$$1/3\ \text{OBSPL} = 1/3\ \text{OBSPSDL} + 10 \log \Delta f \qquad (5)$$

where,

1/3 OBASDL = one-third octave bandwidth acceleration spectral density level in dB

1/3 OBSPSDL = one-third octave bandwidth sound pressure spectral density level in dB

it follows from (5) that:

$$1/3\ \text{OBASDL} = 1/3\ \text{OBAL} - 10 \log \Delta f$$

$$1/3\ \text{OBSPSDL} = 1/3\ \text{OBSPL} - 10 \log \Delta f \qquad (6)$$

The conversion of the extrapolated test result, $1/3\ \text{OBAL}_{test}^{extrap}$ (4) in dB to acceleration spectral density in g^2/Hz (based on one-third octave bandwidth analysis (see appendices D and E) consists of the followin :

Using the first of (6) the extrapolated result of (4) can be expressed as:

$$1/3\ \text{OBASDL}_{test}^{extrap} = 1/3\ \text{OBAL}_{test}^{extrap} - 10 \log \Delta f \qquad (7)$$

Also, since

$$1/3\ \text{OBASDL} = 10 \log (1/3\ \text{OBASD} / 1/3\ \text{OBASD}_{ref}) \qquad (8)$$

and assuming 1/3 $OBASD_{ref}$ = $(2.9 \times 10^{-9}$ grms$)^2$/Hz

then the one-third octave band acceleration spectral density in g^2/Hz can be determined using

$$1/3\ OBASD_{test}\ (g^2/Hz) = (2.9 \times 10^{-9})^2\ [10^{\,0.1(1/3\ OBASDL^{extrap}_{test})}] \qquad (9)$$

4.2 Test Efficiency Factors

In general, the difference between the acoustic test vibration response level (in dB) and the flight vibration response level (in dB) measured at identical locations on the payload is defined as the "Test Efficiency Factor" (TEF). This definition assumes that the acoustic test is performed at the flight acoustic levels. Accordingly, in the herein evaluation, the TEF is defined by:

Test Efficiency Factor (TEF)

$$= 1/3\ OBAL^{extrap}_{test} - 1/3\ OBAL^{meas.}_{flight} \qquad (10)$$

where:

$1/3\ OBAL^{extrap}_{test}$ and $1/3\ OBAL^{meas.}_{flight}$ are obtainte respectively from (4) and measured flight data.

Since 1/3 OBAL is related to 1/3 OBASDL by (5), it follows that TEF is also given by:

$$TEF = 1/3\ OBASDL_{test}^{extrap} - 1/3\ OBASDL_{flight}^{meas.} \quad (11)$$

where 1/3 OBASDL is the acceleration spectral density level based on one-third octave band analysis.

4.3 Extrapolation Uncertainties

The basic data used to extrapolate the acoustic test vibration response data consisted of the following:

a. Acoustic test chamber sound pressure levels.

b. Flight payload bay sound pressure levels on OSS-1 pallet payload.

c. Acoustic test vibration response at the selective locations on the payload.

The acquisition and reduction of the basic data are subject to statistical uncertainties. The uncertainty in sound pressure levels on the payload in the acoustic test chamber and the orbiter payload bay are primarily the results of spatial variation within the test chamber and payload bay and the data reduction process. The uncertainty in the acoustic test payload vibration response is primarily due to data reduction. In addition, the flight

vibroacoustic environment is truly nonstationary but is assumed to be piecewise stationary for data reduction purposes. The data from the acoustic test and the STS-3 flight are not adequate in sample size to accurately determine the probability distribution function of these quantities for confidence limit evaluation. However, based upon past experience (e.g., references (a) and (b)) the values shown in table 3 for the variances of the pertinent data quantities can be assumed as uncertainties to yield a first order estimate of percentage confidence limits. In general, the "K" percent confidence limits (at the 50 percent confidence level) for the true levels of any quantity are defined by:

$$\text{Upper K\% limit} = \mu + k\sigma$$

$$\text{Lower K\% limit} = \mu - k\sigma \qquad (12)$$

where,

$$K\% = (1 - \alpha) = \text{Kth percentage point} \qquad (13)$$

$k = t_{m;\alpha/2} = \alpha/2$ percentage point of Student "t" variable with m degrees of freedom

μ = average of quanity

σ = standard deviatior of quantity

If follows that, since the extrapolated data are based on space averaged sound pressure levels, the "K" percent confidence limits on the levels of the "Extrapolated Test Data" and "Test Efficiency Factors" are defined respectively by:

EXTRAPOLATED TEST DATA

$$\text{Upper K\% limit} = \mu_{\text{extrap}} + k\,\sigma_{\text{extrap}}$$

$$\text{Lower K\% limit} = \mu_{\text{extrap}} - k\,\sigma_{\text{extrap}} \tag{14}$$

where

μ_{extrap} = Average of Extrapolated Test (i.e. extrapolation based on space averaged sound pressure levels)

$$\sigma_{\text{extrap}} = (\sigma^2_{\text{Test Acoustic}} + \sigma^2_{\text{Flt. Acoustic}} + \sigma^2_{\text{Test Vibration}})^{1/2} \tag{15}$$

TEST EFFICIENCY FACTOR

$$\text{Upper K\% limit} = \mu_{\text{Eff.Fact.}} + k\,\sigma_{\text{Eff.Fact.}}$$

$$\text{Lower K\% limit} = \mu_{\text{Eff.Fact.}} - k\,\sigma_{\text{Eff.Fact.}} \tag{16}$$

where,

$$\text{Test Efficiency Factor} = 1/3\ \text{OBAL (Extrapolated Test)} - 1/3\ \text{OBAL (Measured Flight)} \tag{17}$$

$\mu_{\text{Eff.Fact}}$ = Measured Efficiency Factor (i.e. efficiency factor based on average extrapolated test data and measured flight data).

$$\sigma_{\text{Eff.Fact.}} = (\sigma^2_{\text{extrap}} + \sigma^2_{\text{Flt.Vib.}})^{1/2} \qquad (18)$$

4.4 Extrapolated Test Data

The acoustic induced vibration responses of the DATE high frequency accelerometers expected to occur during the STS-3 flight of the OSS-1 payload were predicted by extrapolating the ground acoustic test vibration data based on the flight measured space average acoustic levels on the OSS-1 payload (table 2 and figure 15). The validity of the extrapolations depends on the linearity in the vibration response data with the acoustic input test levels. As is illustrated by the results of appendix C, the linearity condition is reasonably satisfied for the purpose of extrapolating the DATE test data over the range of flight acoustic environments in the STS payload bay.

The extrapolated test vibration data are shown in appendix D. The 1/3 octave band acceleration levels from the ground acoustic test are shown in column 2 of tables D-1 through D-11 and the extrapolated mean acceleration levels are shown in column 3. In addition, the upper and lower 95 percent confidence limits on extrapolated data are shown in column 4 and 5 respectively. The extrapolated results in terms of 1/3 octave band acceleration density in dB and g^2/Hz are shown in tables D-12 through D-33.

5.0 STS-3/OSS-1 PAYLOAD FLIGHT DATA

During the STS-3 launch of the Space Shuttle (OV-102 vehicle), sound pressure levels and vibration levels were measured on the OSS-1 payload inside the payload bay of the orbiter using the same DATE instrumentation as was used

during the acoustic test. The basic OSS-1 flight data used for the comparative evaluation presented herein were provided by the NASA "30 Day Report" (reference a). A summary of the pertinent flight data used for the evaluation is presented in appendix E. It should be noted that the data correspond to a launch vehicle configuration and flight conditions defined as the following:

- o OV-102 vehicle
- o Launch from the Kennedy Space Center (KSC)
- o No thrust augmentation
- o Full complement of thermal radiator panels
- o Payload bay vents fully opened at all times
- o Worst case flights event at lift-off from T-6 to T + 12 sec

6.0 COMPARISON OF MEASURED FLIGHT AND EXTRAPOLATED TEST DATA

The flight measured OSS-1 pallet payload component vibration data are compared to the vibration data extrapolated from the acoustic test in terms of Test Efficiency Factor (equation 10) and 1/3 octave band acceleration spectral density levels (1/3 OBASDL).

The test efficiency factors and estimated 95% confidence limits, as defined by equations 16-18, are presented in tables 4 through 14 and figures 16 through 26. The absence of a data "value" in these tables and figures is attributed to invalid data "point" (e.g. off the bottom scale) in the flight measured data plots. The comparison of acceleration spectral density (1/3 OBASDL) between flight measured data and extrapolated test data is shown in figures 27 through 37. In these figures, the estimated 95% confidence limits of $\pm$ 1 dB on the measured flight data are not shown.

For additional comparisons, the data of tables 4 through 14 and figures 16 through 26 are grouped in accordance with the payload "zone" in which the component is mounted. A zone is defined as a major area of the OSS-1 payload in which components can be mounted. For the OSS-1 payload, a determination of the particular zone in which a component is mounted was and can be based on the following description:

Zone 1--Payload primary structure within the proximity of the payload--orbiter vehicle separation plane.

Zone 2--Payload primary and secondary structure (exclusive of mounting brackets) not included in Zone 1.

Zone 3--Payload structures specifically designed for mounting of components such as shelving, platforms, or brackets.

Zone 4--Payload large surface area, lightweight structures at outboard areas which respond primarily to acoustic pressure forces.

Based on the measurement description of table 1, the measurement numbers grouped in accordance with the payload component mounting zone are summarized in table 15. Grouping the data in accordance with table 15, the estimated test efficiency factors for Zones 2, 3, and 4 are as shown in figures 38 through 40. No data were grouped under Zone 1.

The comparison of measured flight and extrapolated vibration test data represent comparison of worst case events during the ascent phase from T-6 to

T+12 sec. The extrapolated data correspond to test data normalized to the maximum flight acoustic spectrum measured on the payload. The measured flight data correspond to the envelope of data measured during the flight. Preliminary time correlation studies indicate these worst case events to be weakly correlated in time with the duration of low frequency transient vibration responses at the payload trunnions. The maximum frequency cutoff in these low frequency transient responses was approximately 35 Hz. Because of these two observations, it follows that the random vibration results of tables 4 through 18 and figures 16 through 40 are minimally contaminated by the effect of transient vibration responses.

7.0 CONCLUSIONS

The OSS-1 pallet payload related vibroacoustic data obtained during the NASA-GSFC system level acoustic test provided a basis for evaluating and correlating the STS-3 flight measured data with acoustic test data. By this study, a greater insight is provided into the characteristics of vibroacoustic response of pallet payload components in the orbiter payload bay during STS flights.

Based on the results of this study the following conclusions are made:

a. Pallet payload component random vibration response measured during a STS flight, generally, can exceed the vibration response measured during a pallet acoustic test by an average of 3 dB in the frequency range from 100 to 1000 Hz, an average rate of-7 dB/oct. from 31.5 to 100 Hz, and an average rate of 12 dB/oct. from 1000 to 2000 Hz.

b. The exceedance of flight response over acoustic test reponse will be most significant in the high and low frequency regions, and will be greater for mounting locations on primary and secondary structure (exclusive of mounting brackets) not within the proximity of payload-orbiter vehicle interface than for locations on structure specifically designed for mounting components (e.g. shelving/platforms or brackets) or on large surface area, lightweight structure.

c. The exceedance of flight response over acoustic test response may be attributed to the characteristic of the acoustic field in the payload bay or to the addition of mechanical energy transmission to payload components through the orbiter-payload structural interface. The transmission of mechanical energy is not normally simulated during the acoustic test.

d. Test efficiency correction should be applied to test data when developing STS pallet payload component random vibration criteria based on pallet acoustic test data.

e. Additional studies should be performed to accurately assess the significance of low frequency transient contribution to the flight response of STS payload components.

REFERENCES

a. A. F. White, J.A. Garba, et. al., "Payload Bay Acoustic and Vibration Data From STS-3 Flight", DATE Report 004, NASA, June 1982

b. F. J. On, "Evaluation of Space Transportation System (STS) OV-102 Orbiter Payload Bay Acoustic Environment", NASA TM 84958, GSFC, December 1982

FIGURES AND TABLES

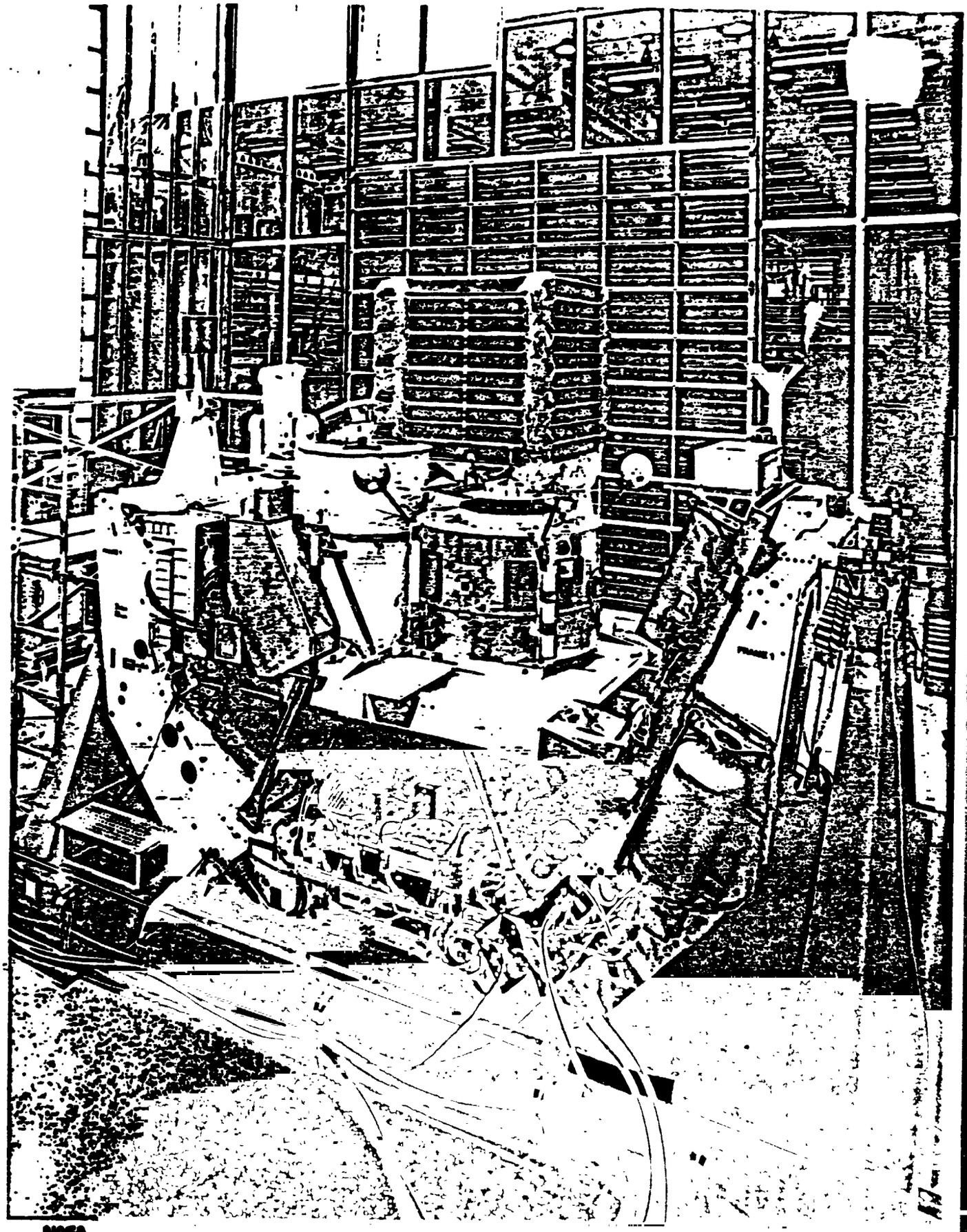

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Figure 1 OSS-1 Pallet Payload without Thermal Blankets (Fwd. View)

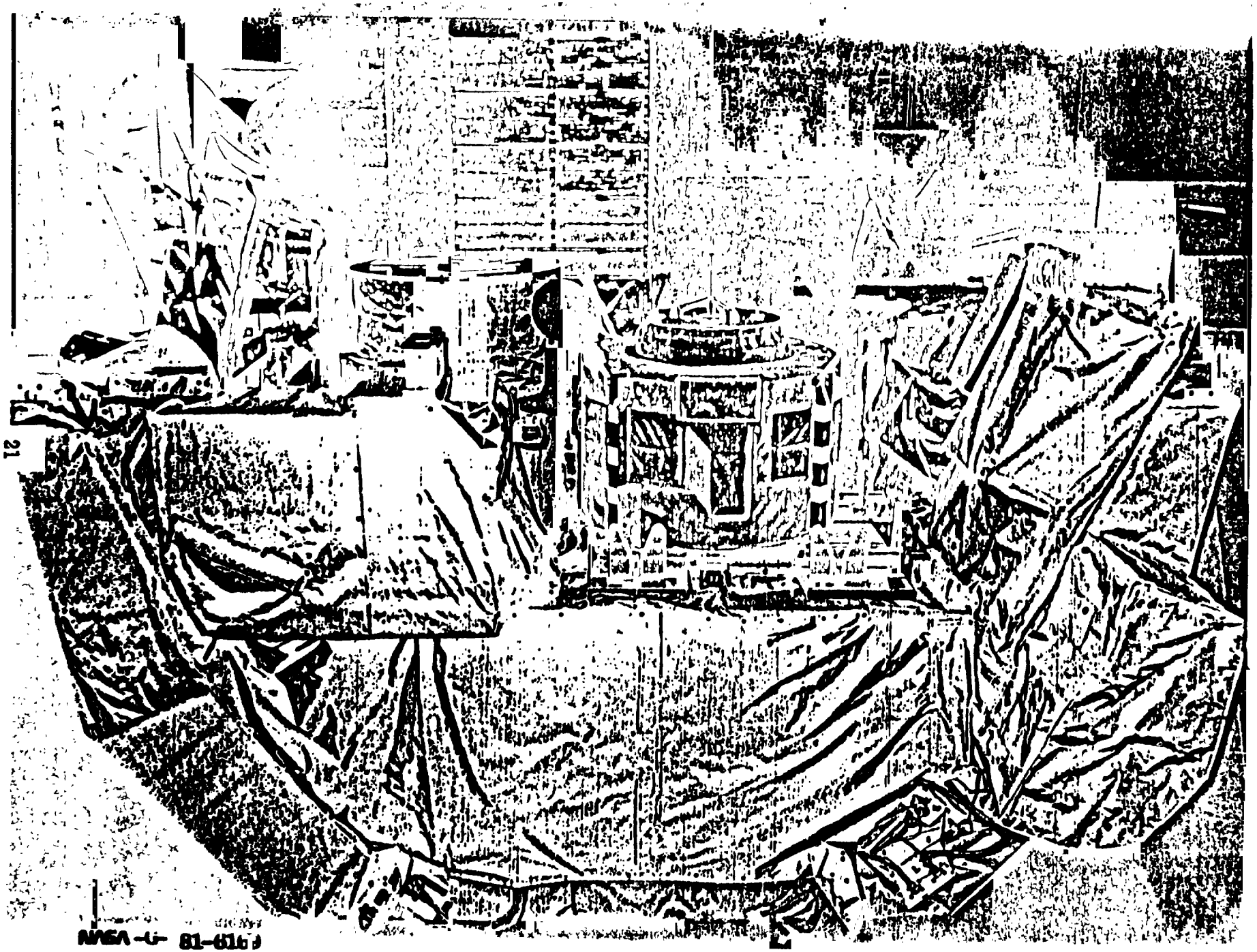
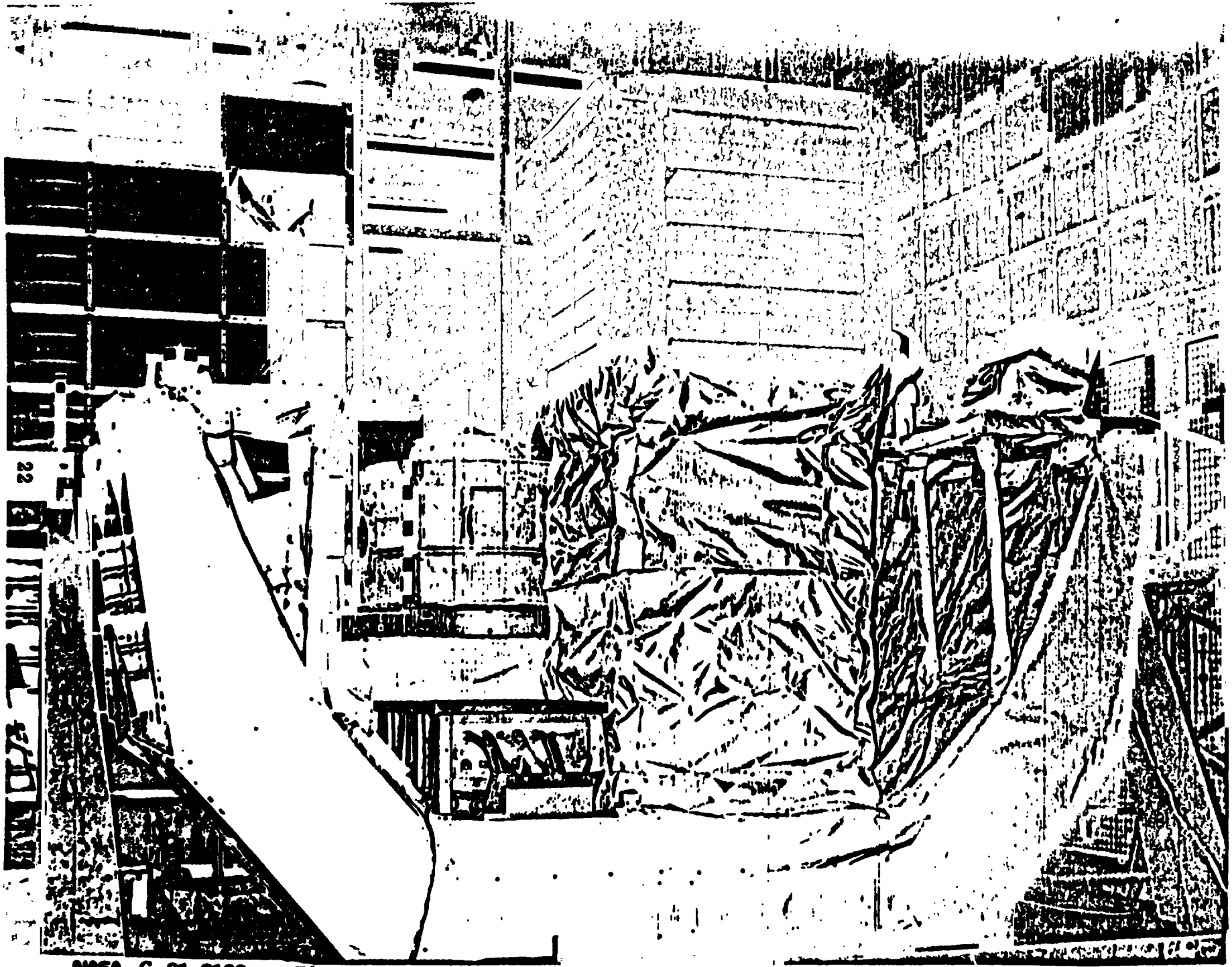


Figure 2 OSS-1 Pallet Payload with Thermal Blankets (Fwd. View)



NASA-G-81-6188 Figure 3 OSS-1 Pallet Payload with Thermal Blankets (Aft View)

LFAM: Inside TCE
Outside TCE

HFA: Inside TCE Fwd Inbd Cor (x)
Aft Inside TCE (y)

HFAM: Platform No. 4

HFA: SRPA Instr Support
(x,z)

LFAM: Boom
off Platform
No. 5

FWD

HFAM: Off Vert.
Platform

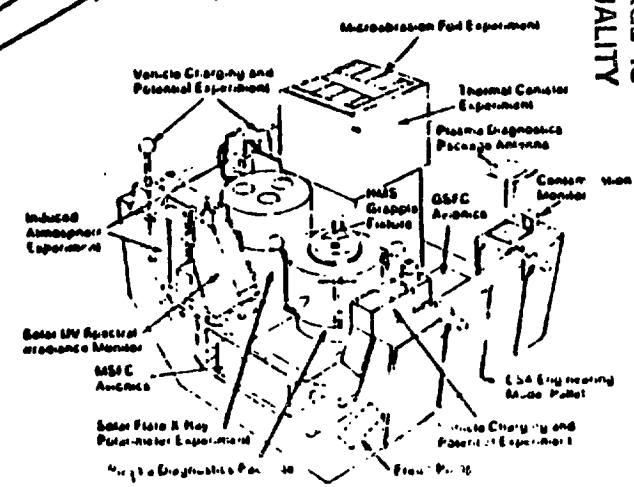


Figure 4 OSS-1 Pallet Payload Transducer Locations

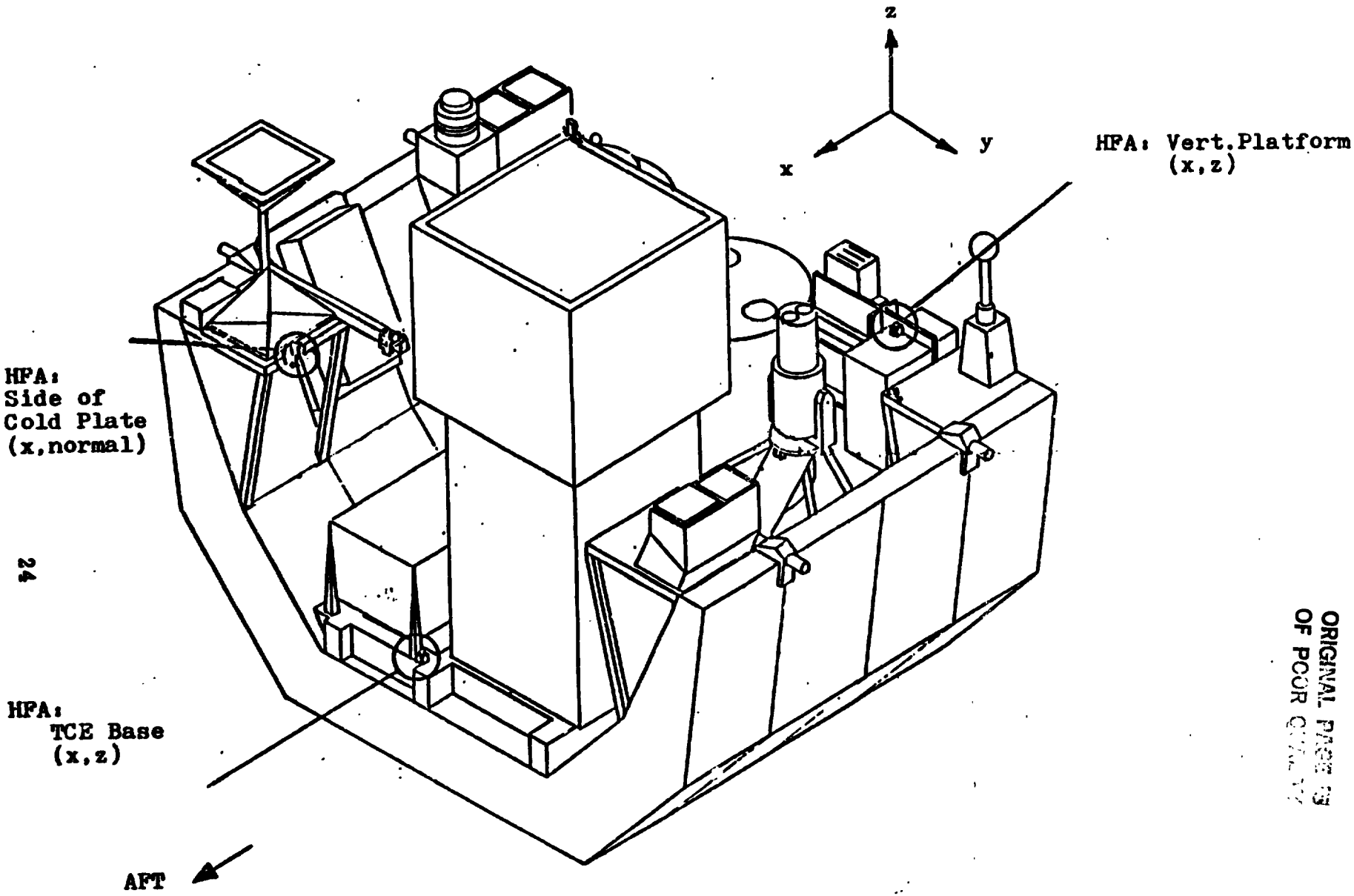


Figure 5 OSS-1 Pallet Payload Transducer Locations

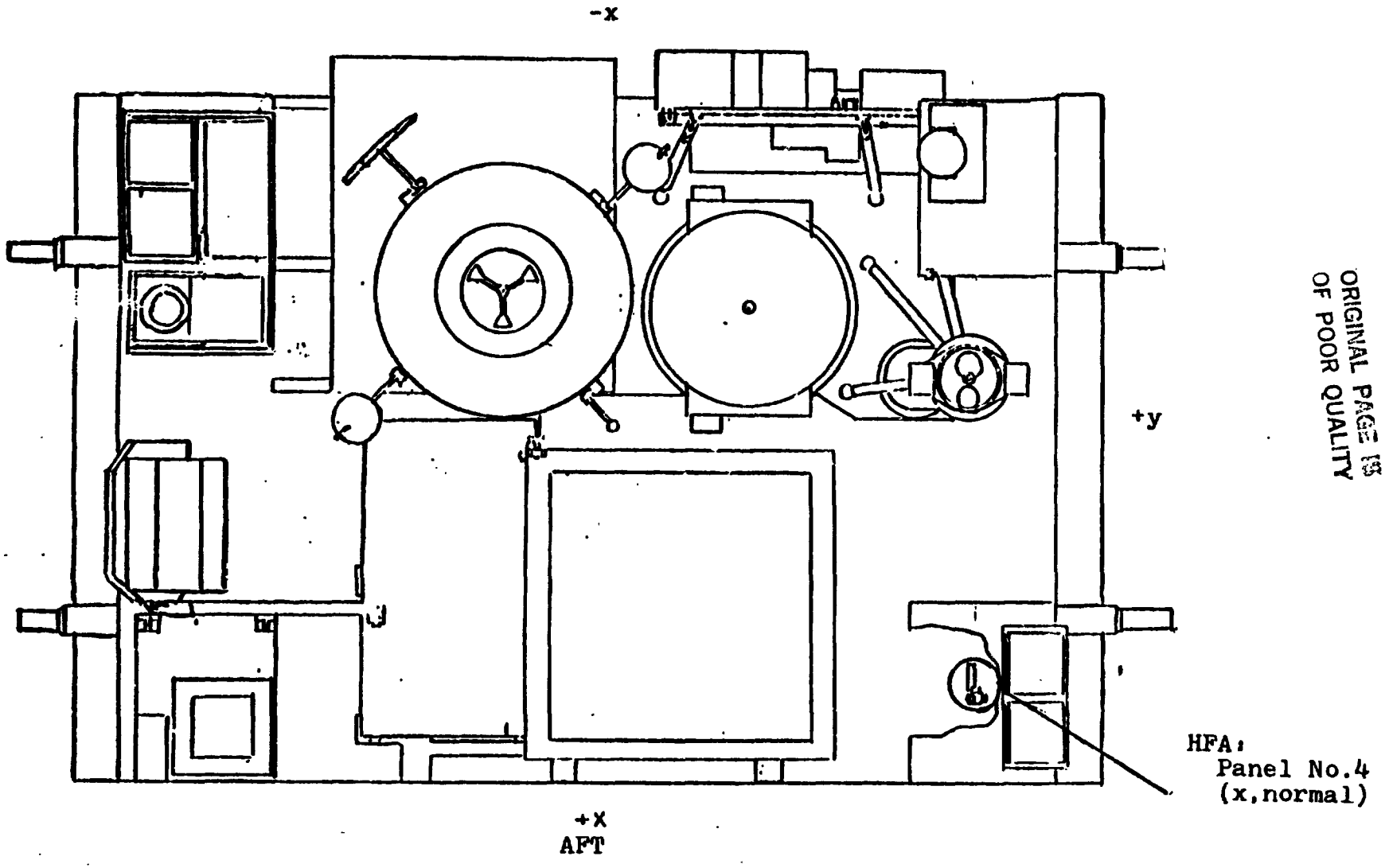


Figure 6 OSS-1 Pallet Payload Transducer Locations

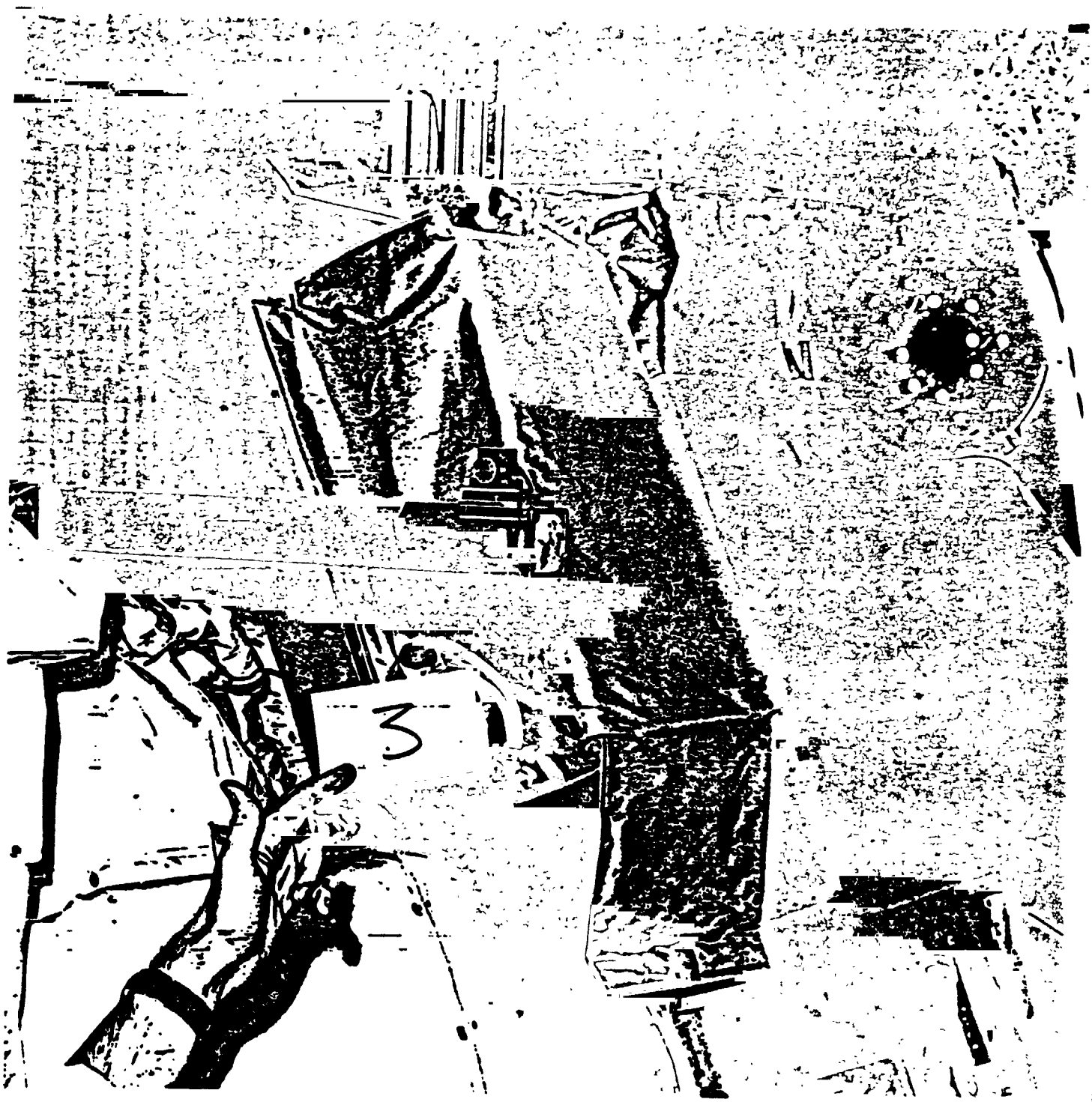


Figure 7 Microphone M3 - Boom off Platform No.6

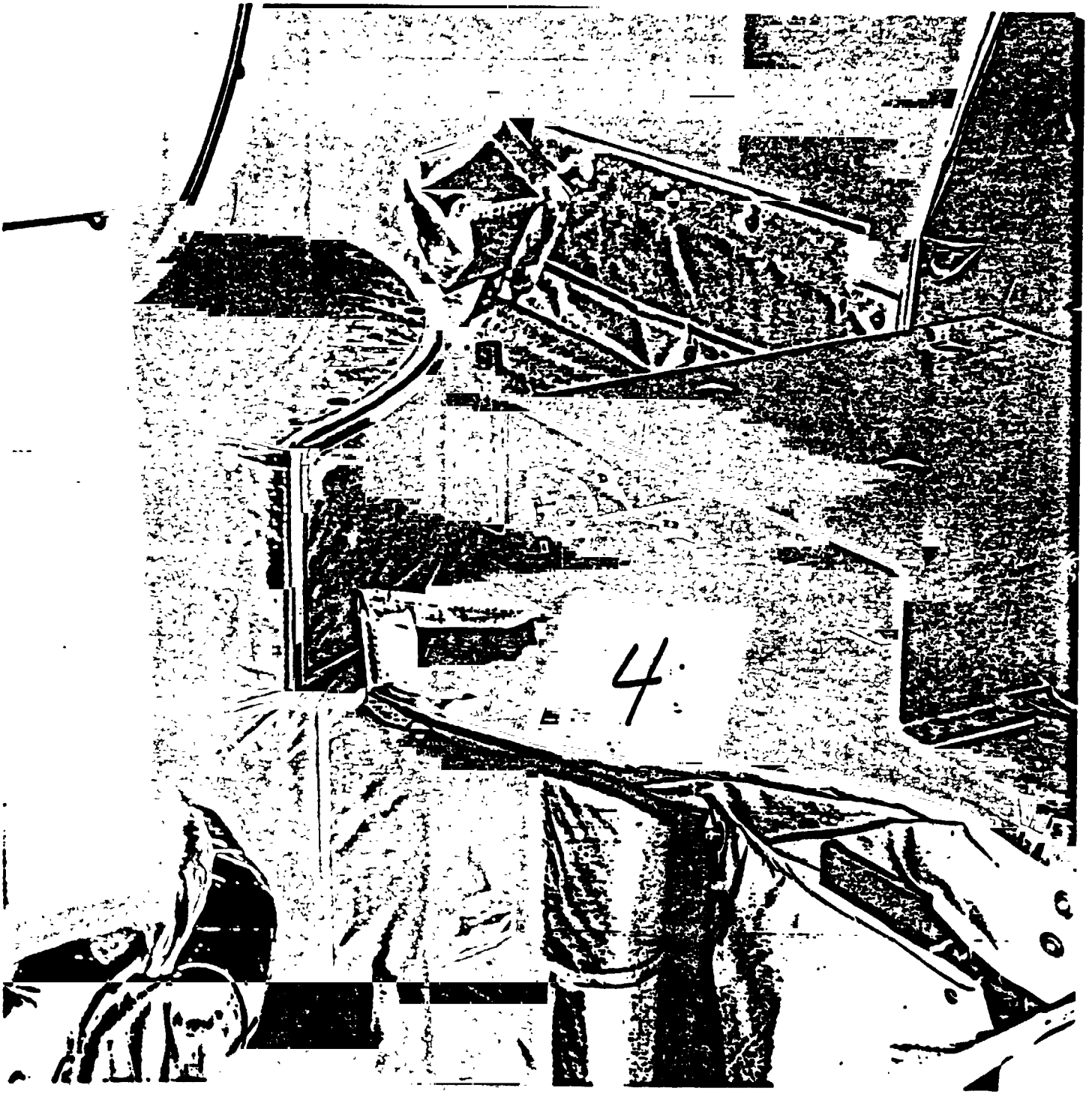


Figure 8 Microphone M4 - Platform No. 4

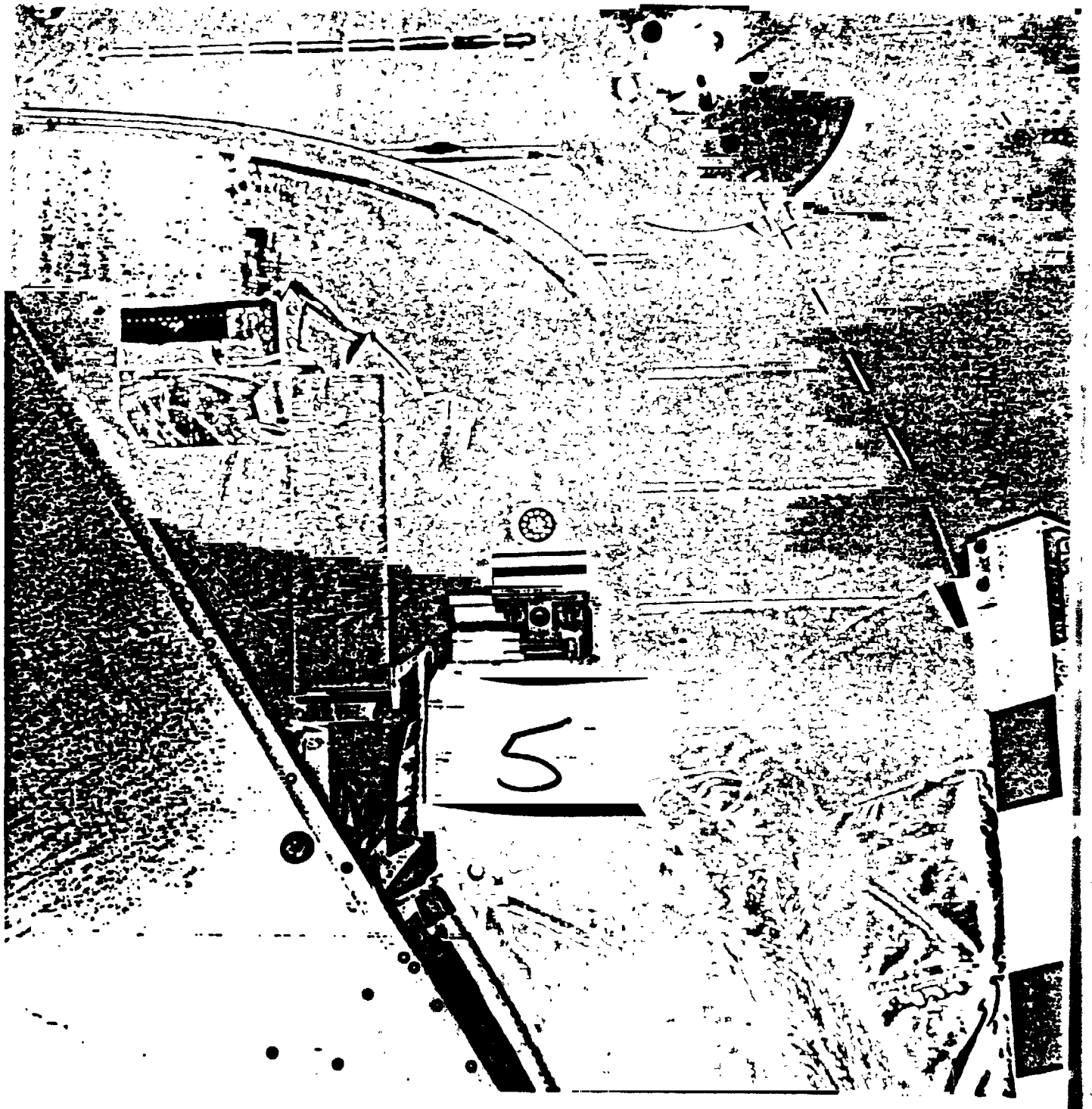


Figure 9 Microphone M5 - Boom off Vertical Platform

Figure 10 Hi-Freq. Accelerometer - Vertical Platform

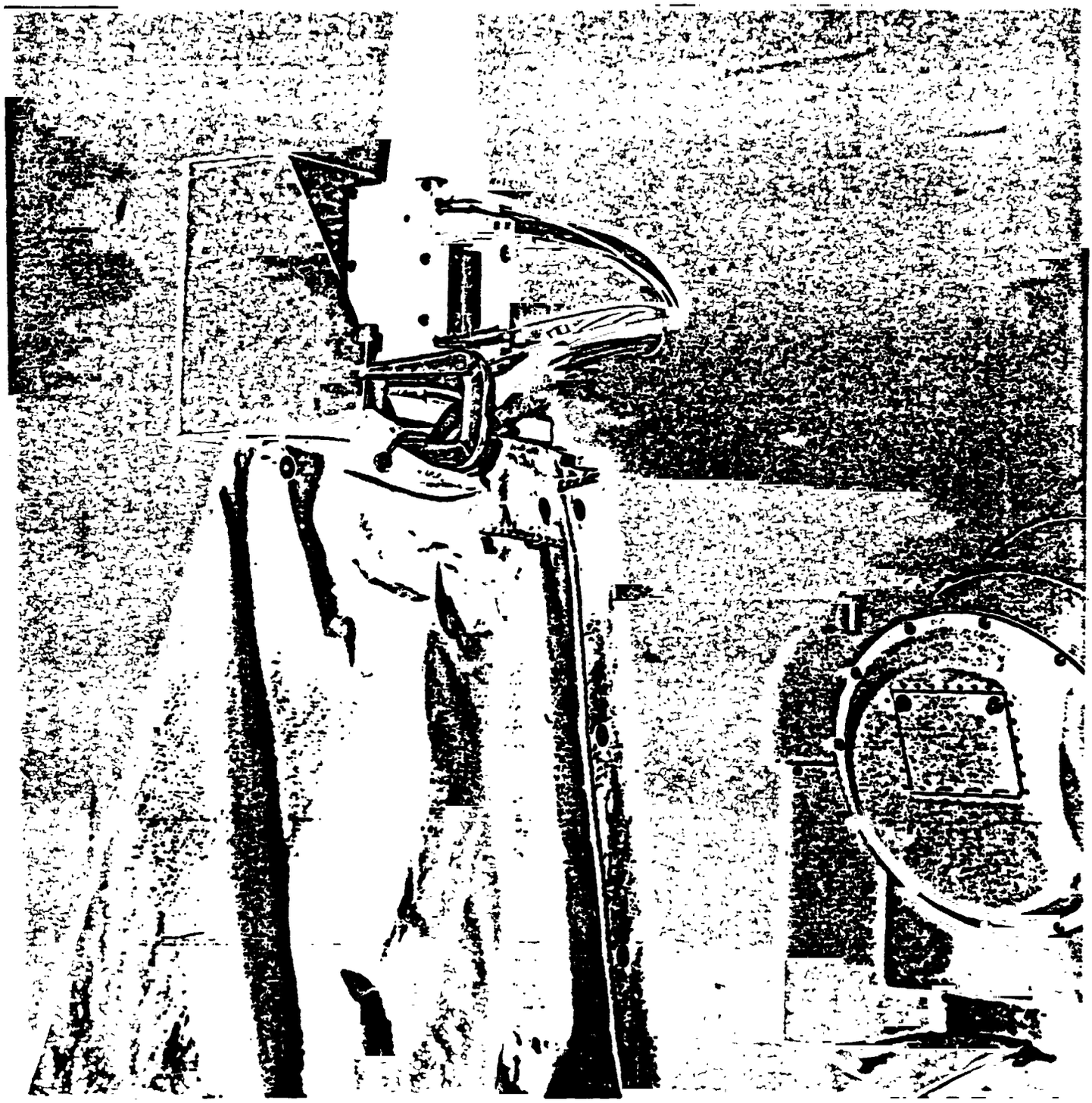


Figure 11 Hi-Freq. Accelerometer
SRPA Instrument Support Bracket

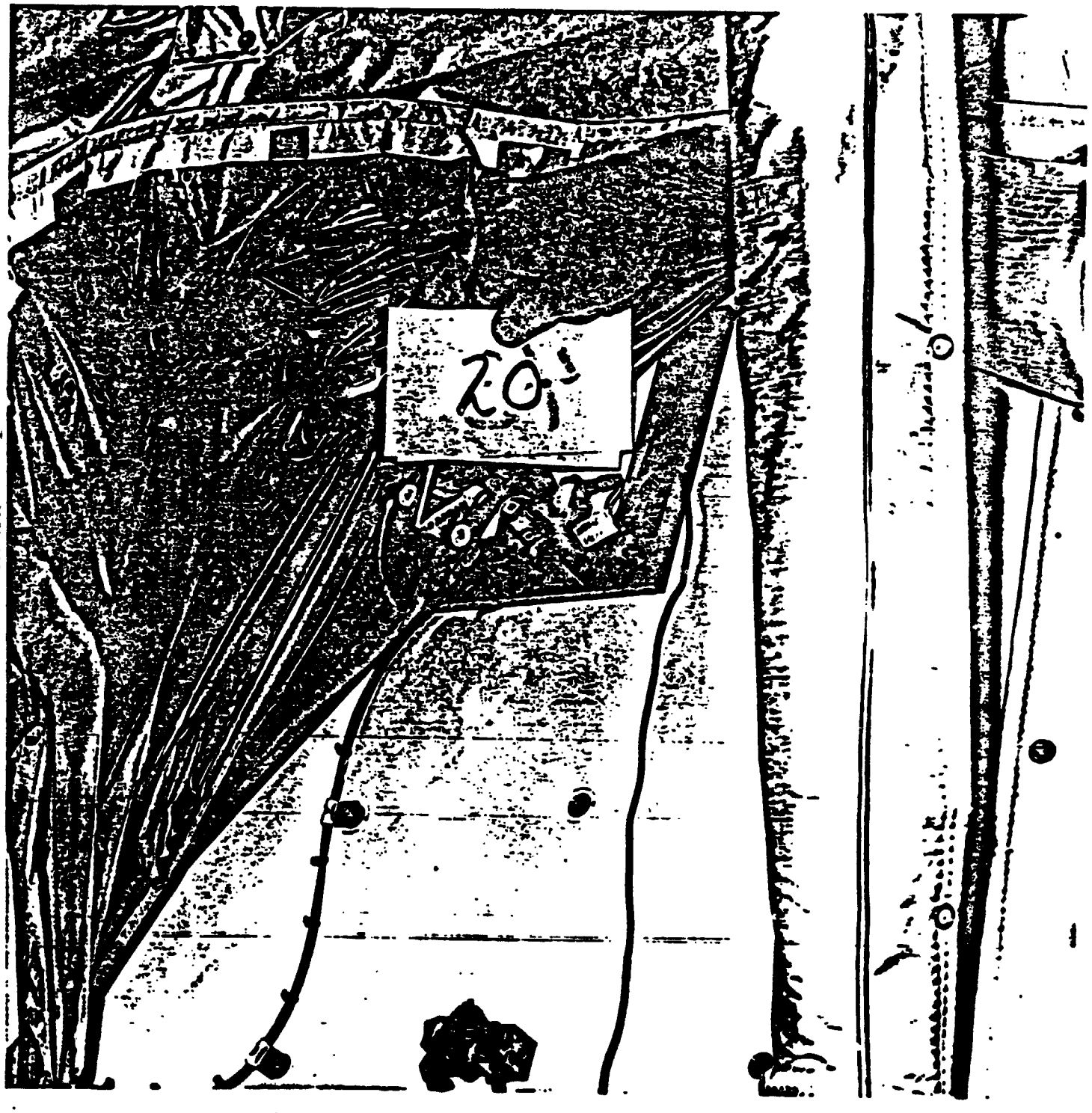


Figure 12 Hi-Freq. Accelerometer
Panel No.4 Central Insert

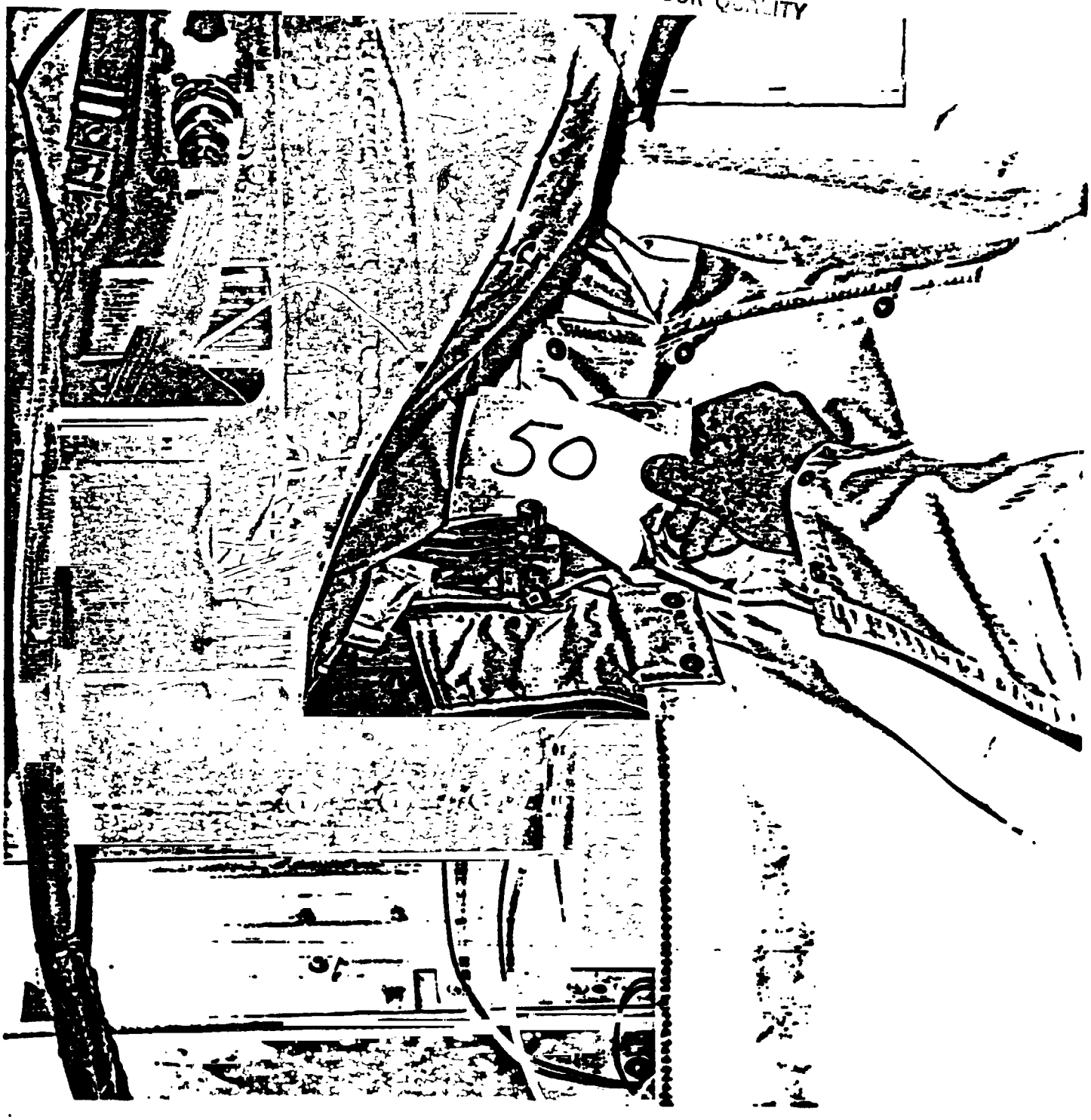


Figure 13 Hi-Freq. Accelerometer
Thermal Cannister Base

Figure 14 Hi-Freq. Accelerometer
Side of Cold Plate

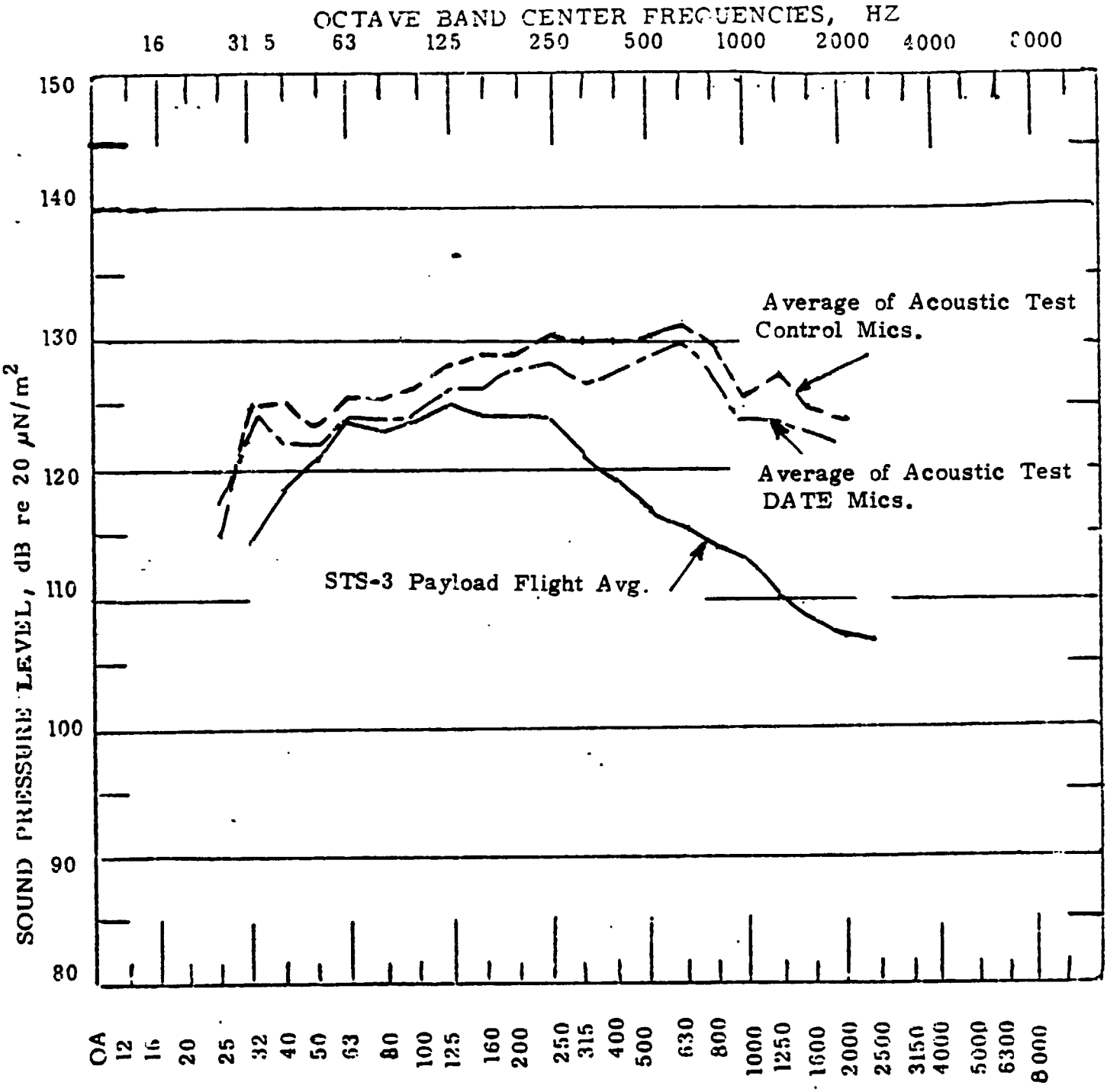


Figure 15- STS-3/OSS-1 Payload Acoustic Environment

1/3-OB Sound Pressure Level in dB

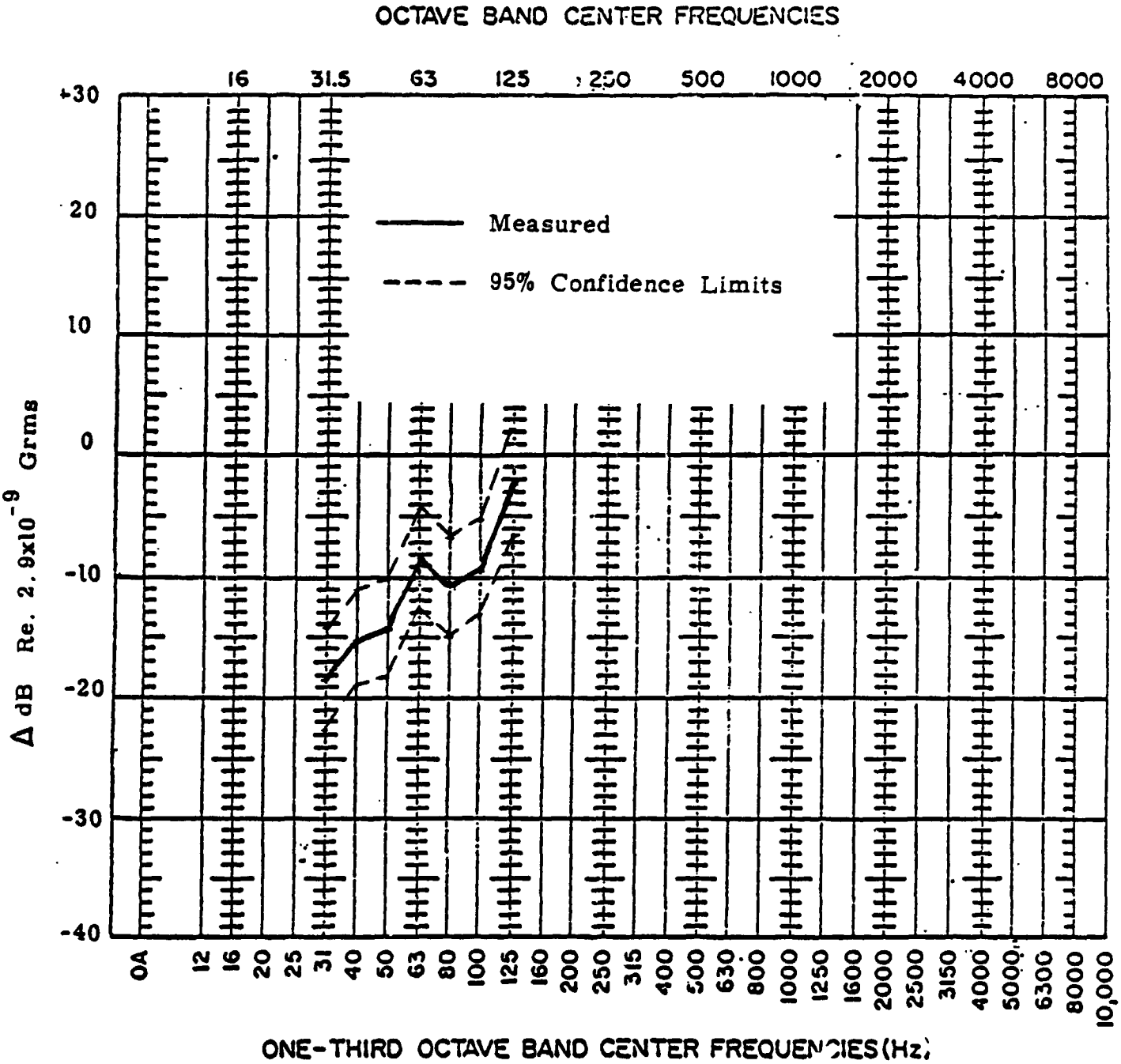


Figure 16 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc · Aft Side Vertical Platform - 9302A
Dir: X
Group: ZONE 2

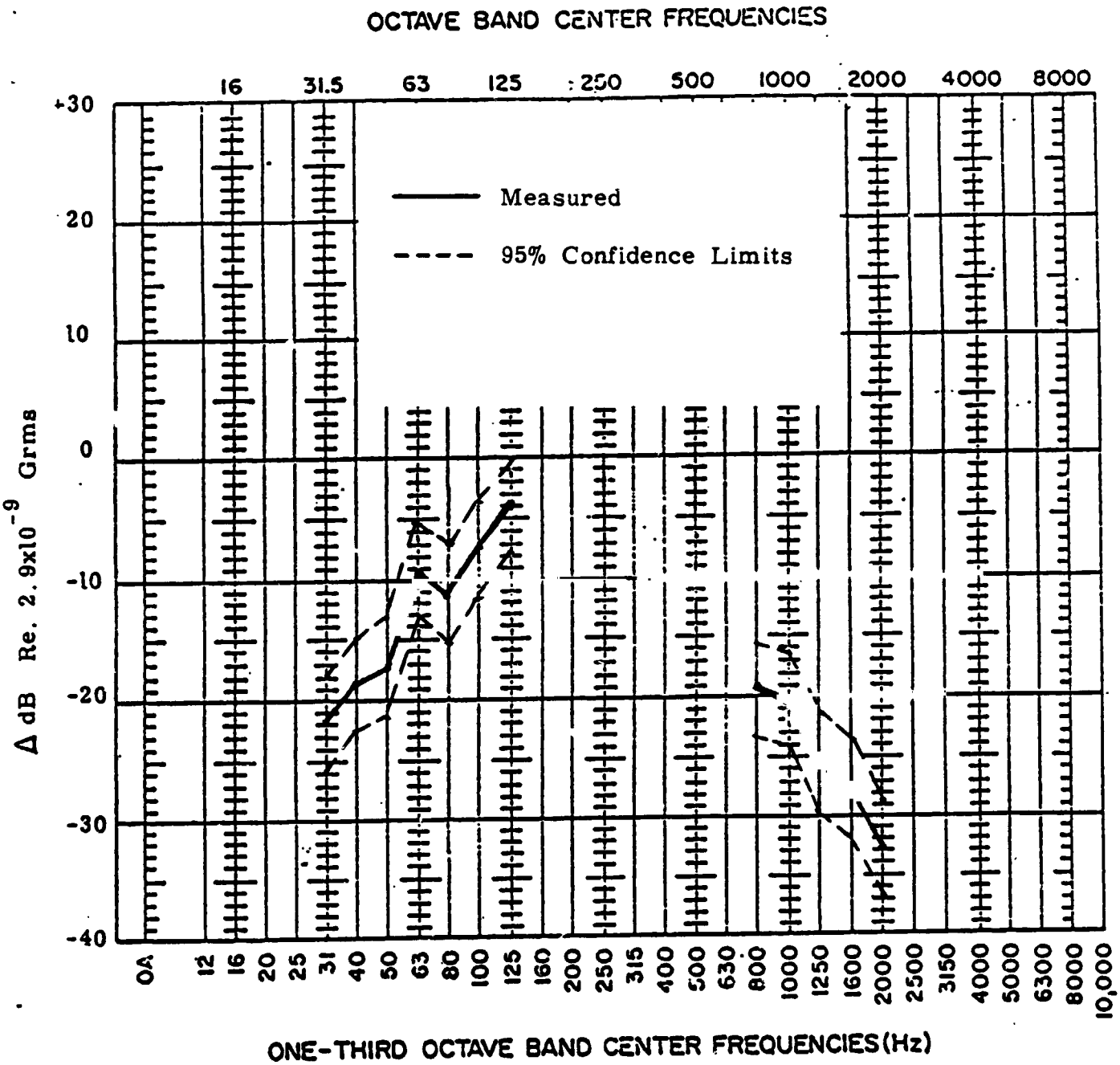


Figure 17 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc: Aft Side Vertical Platform - 9303A
Dir: Z
Group: ZONE 2

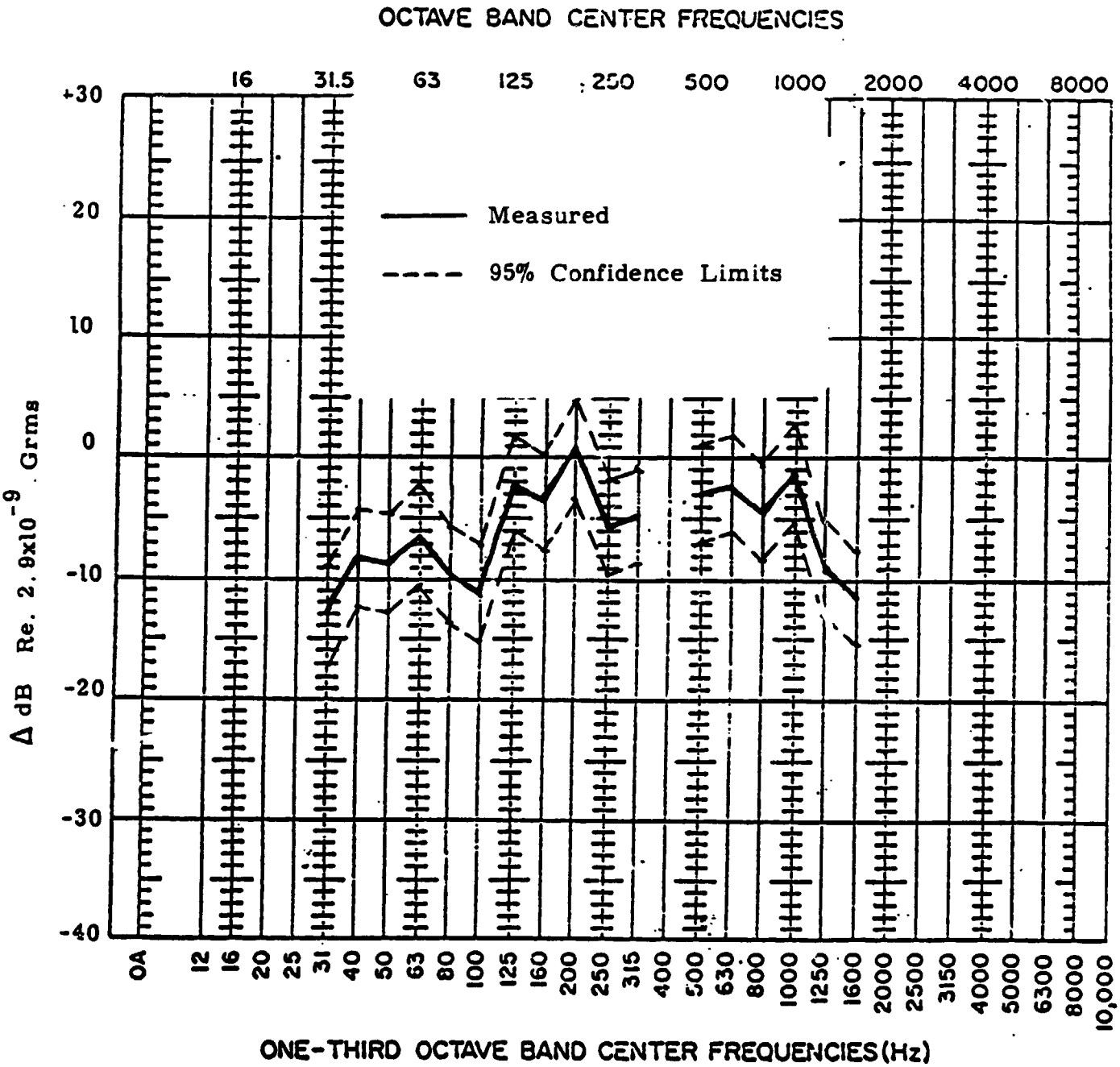


Figure 18 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc: On Support Bracket for SRPA Instrument - 9294A
Dir: -X
Group: ZONE 3

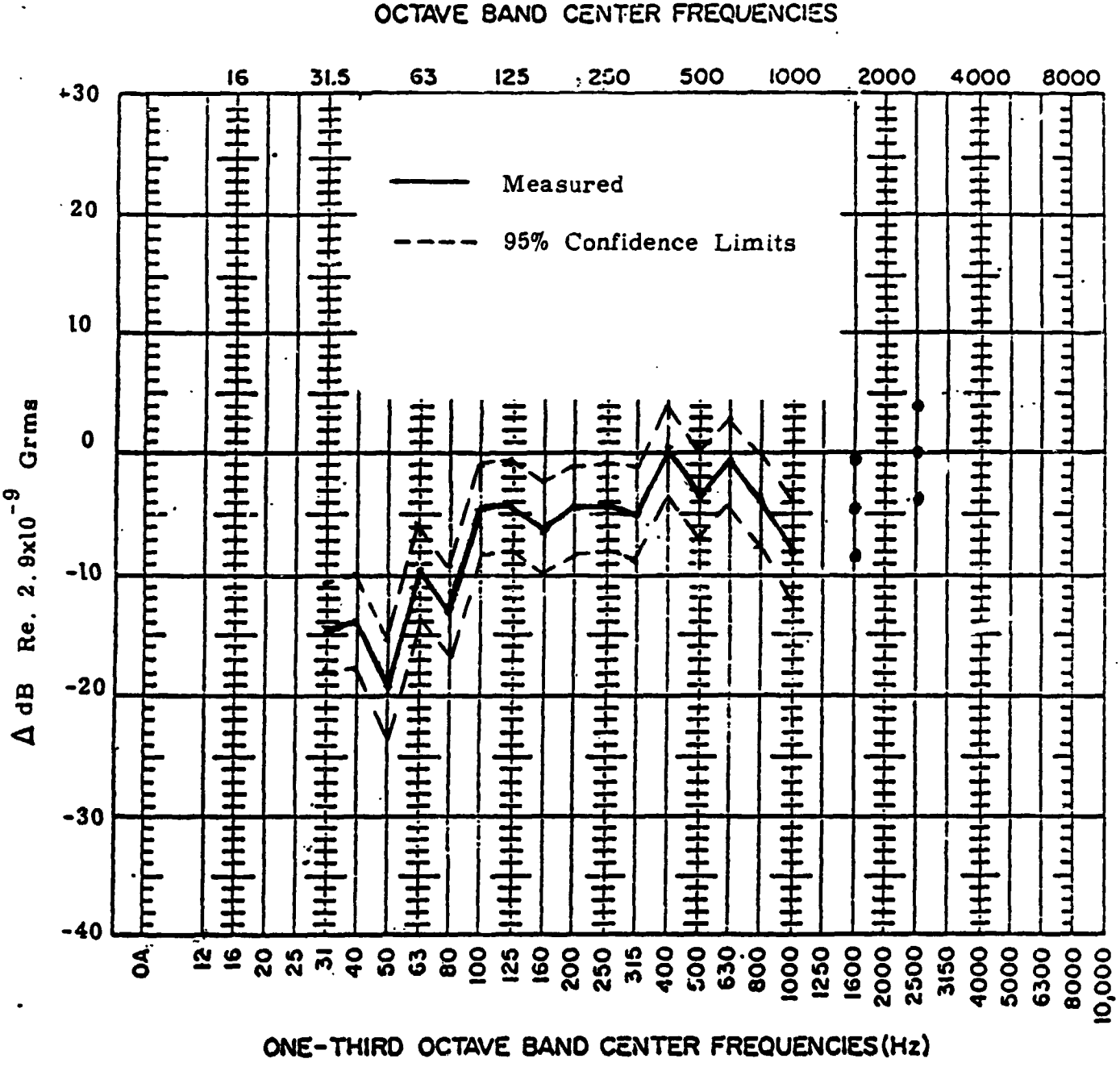


Figure 19 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc . On Support Bracket for SRPA Instrument - 9295A
Dir: Z
Group: ZONE 3

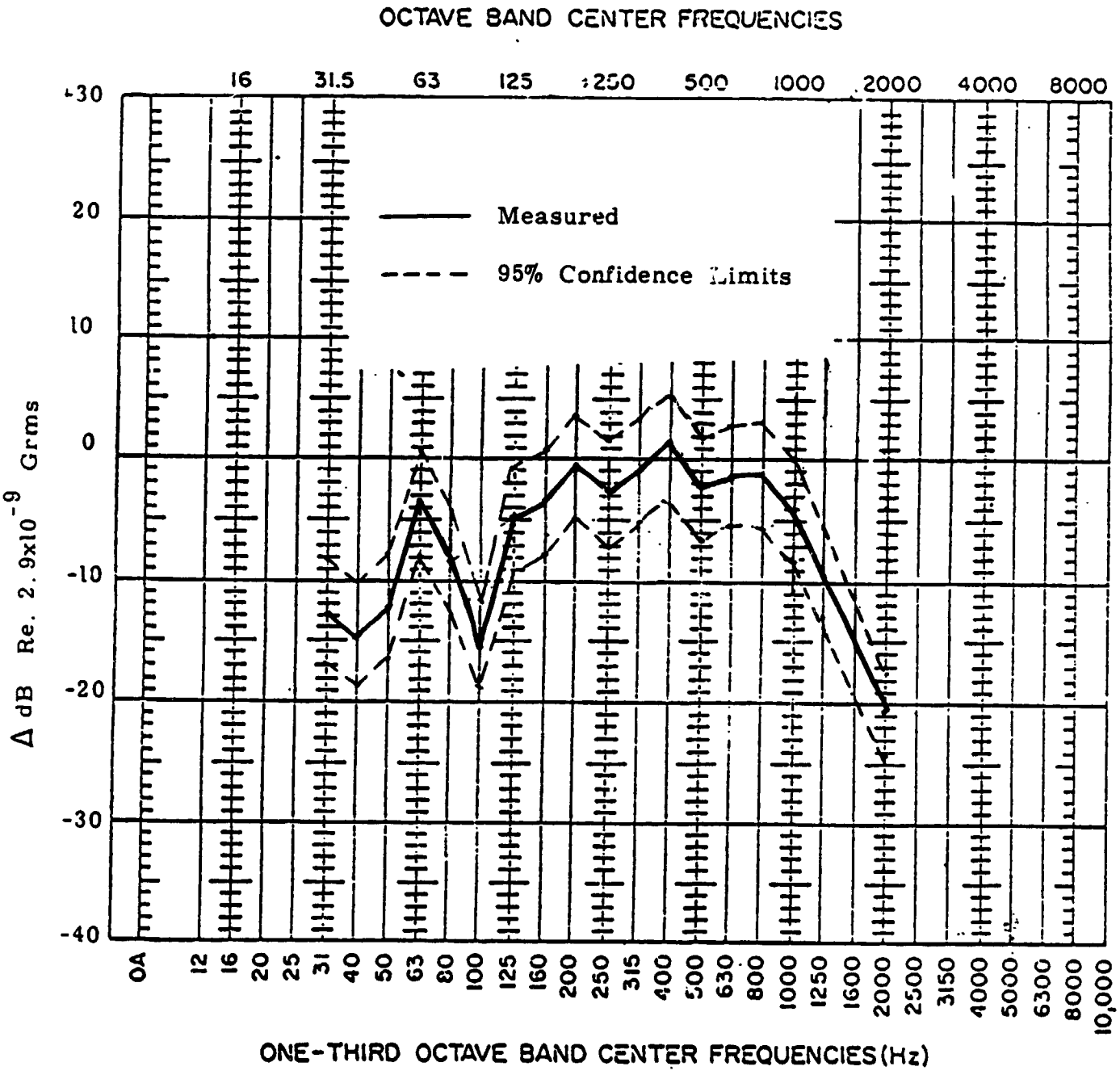


Figure 20 - Aoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc · Panel No 4 Central Insert - 9292A
Dir: X
Group: ZONE 4

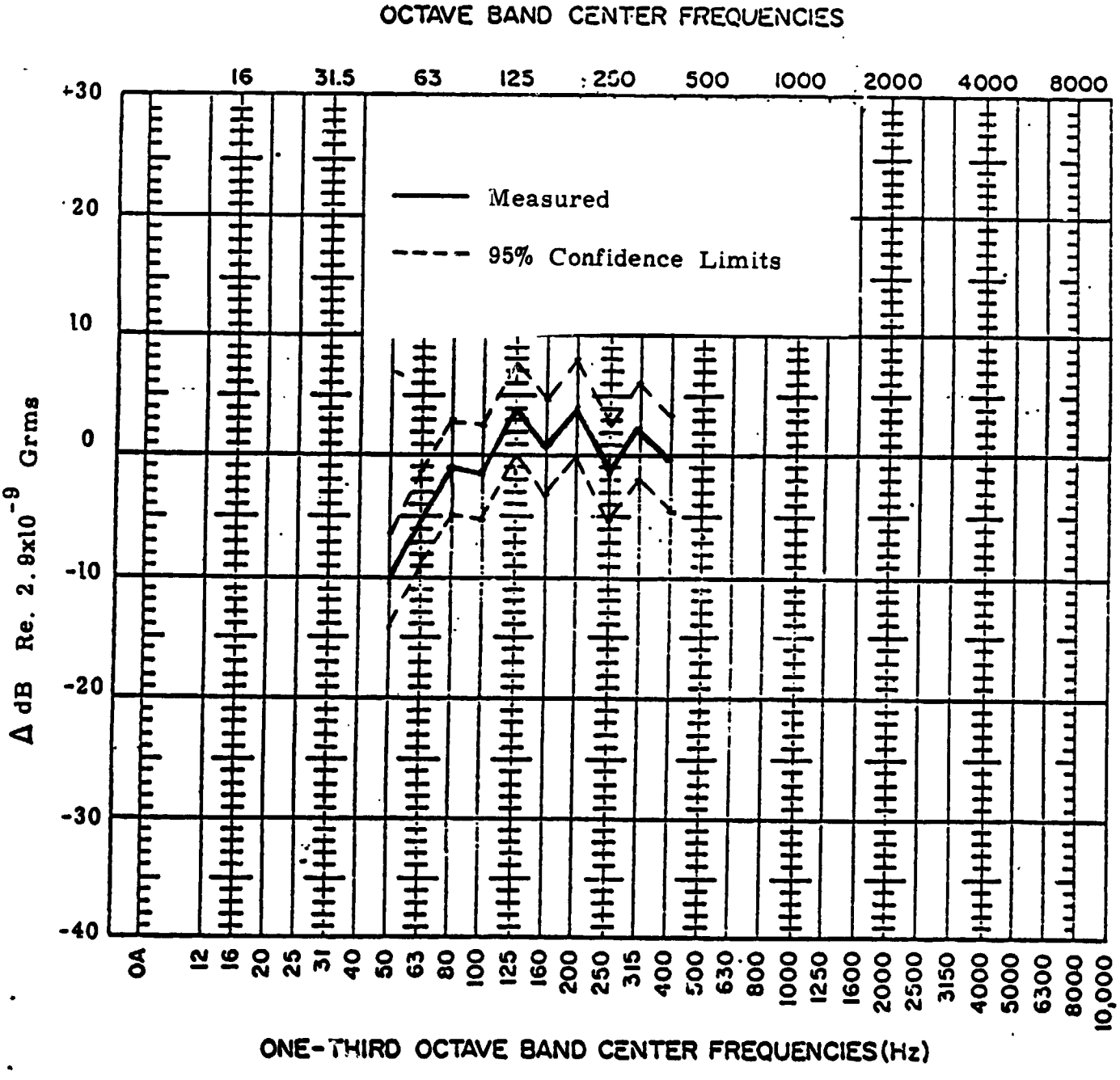


Figure 21 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc - Panel No 4 Central Insert - 9293A
Dir: Normal
Group: ZONE 4

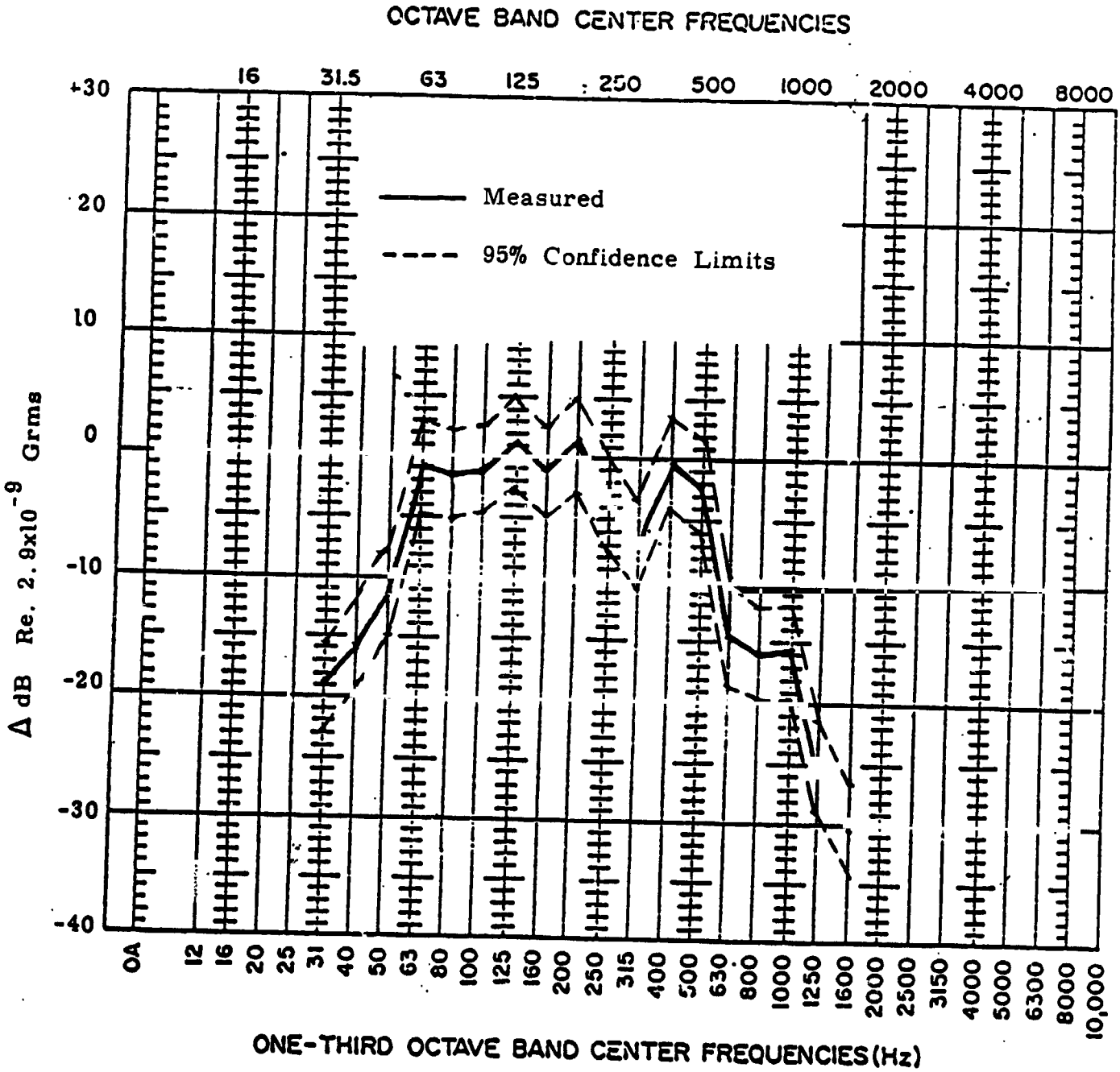


Figure 22 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc · Aft Side Thermal Canister Base - 9297A
Dir: Z
Group: ZONE 2

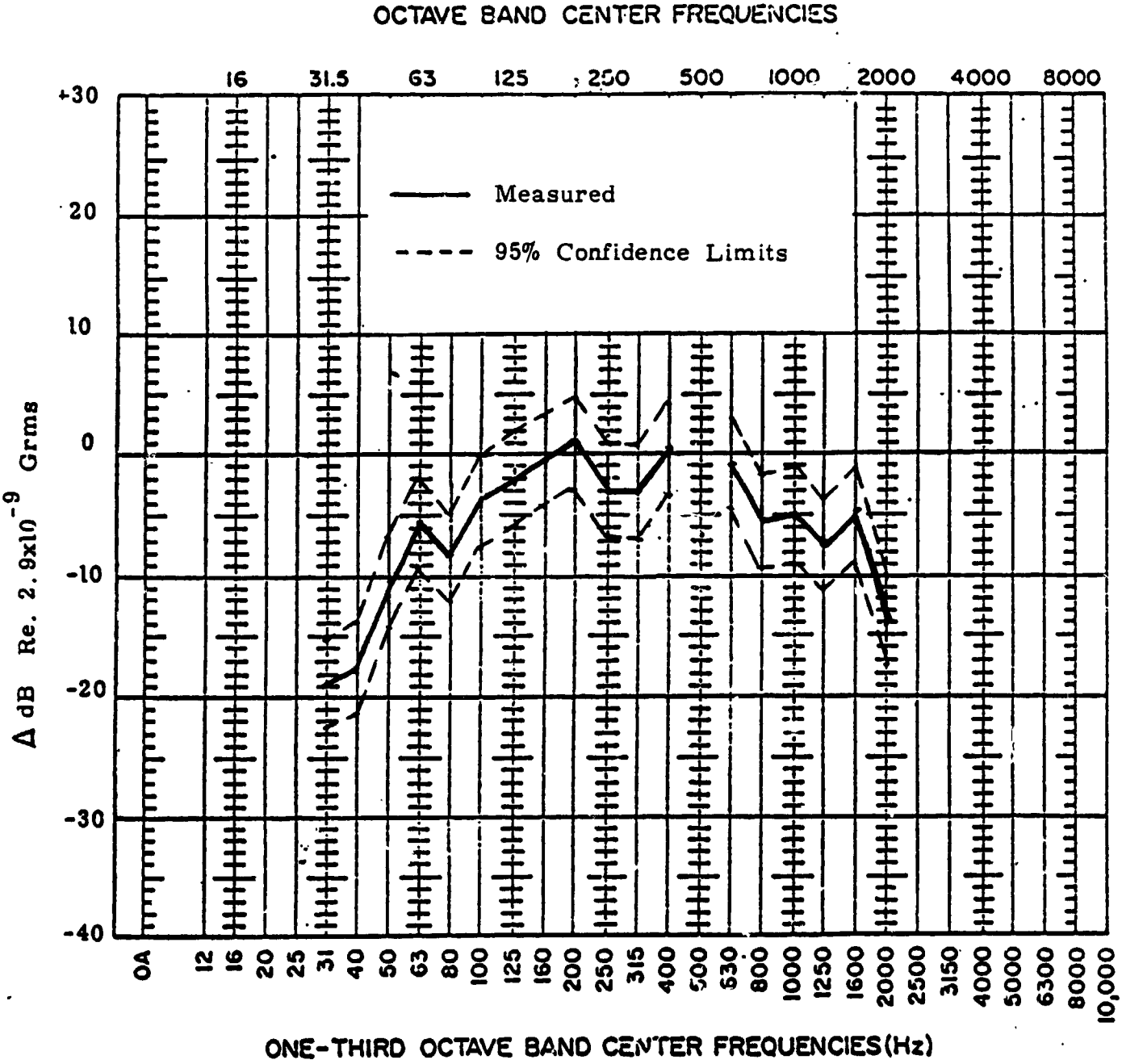


Figure 23 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc: Inside Thermal Canister Fwd Inbd Corner - 9298A
Dir: X
Group: ZONE 3

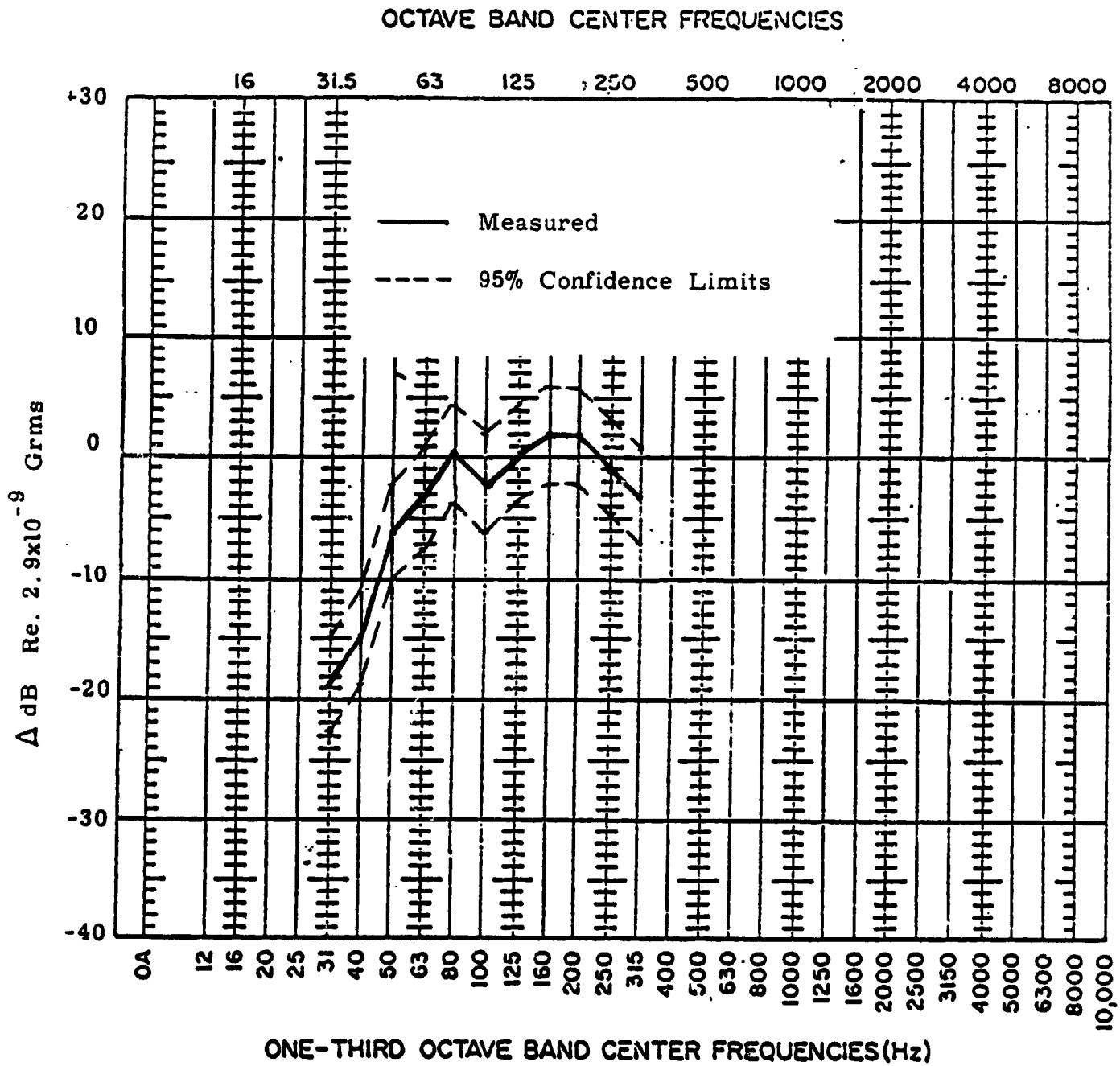


Figure 24 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc · Aft Inside Thermal Canister - 9299A
Dir: -Y
Group: ZONE 3

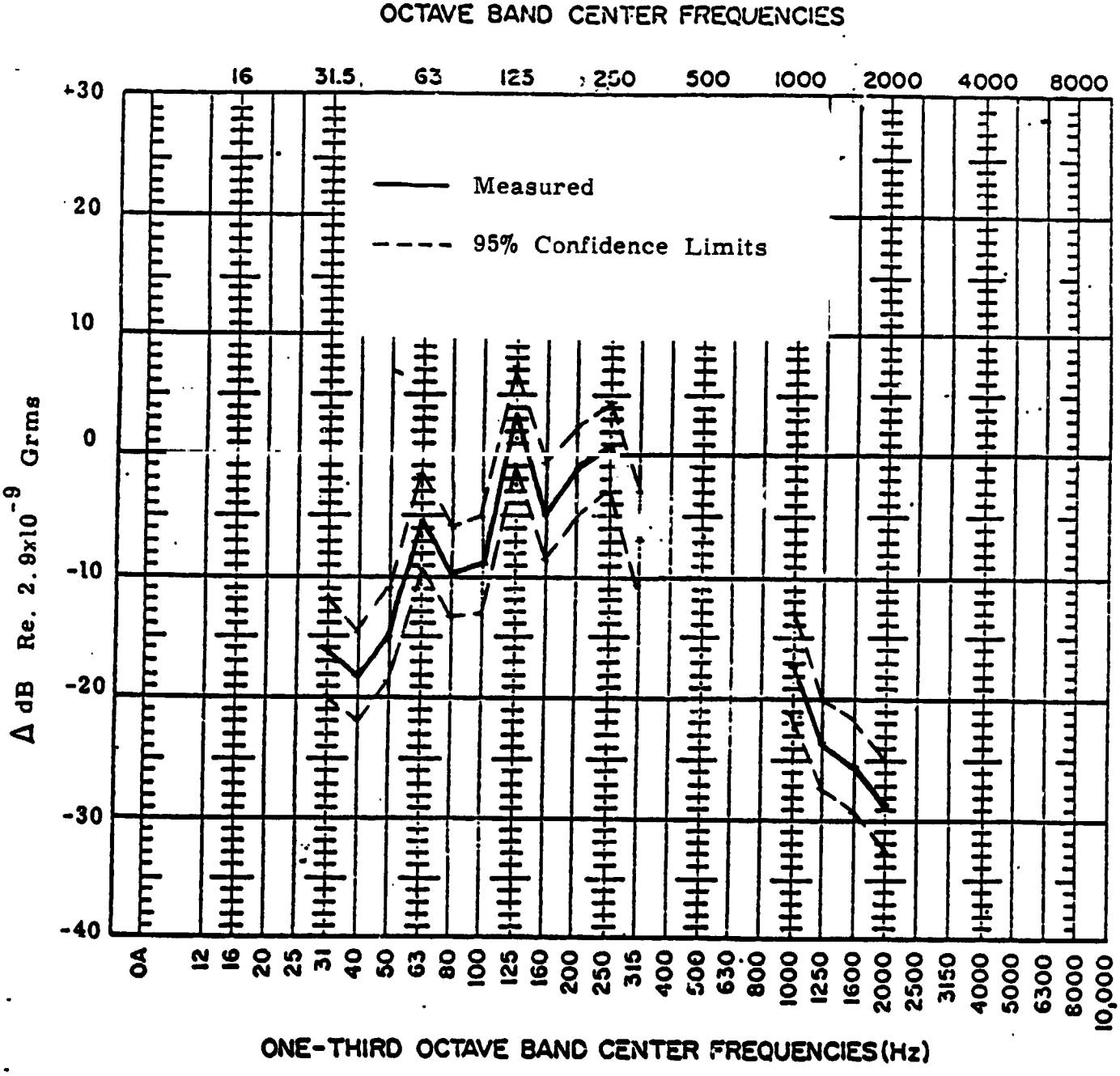


Figure 25 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc · Side of Cold Plate X-Axis - 9300A
Dir: In-plane X
Group: ZONE 2

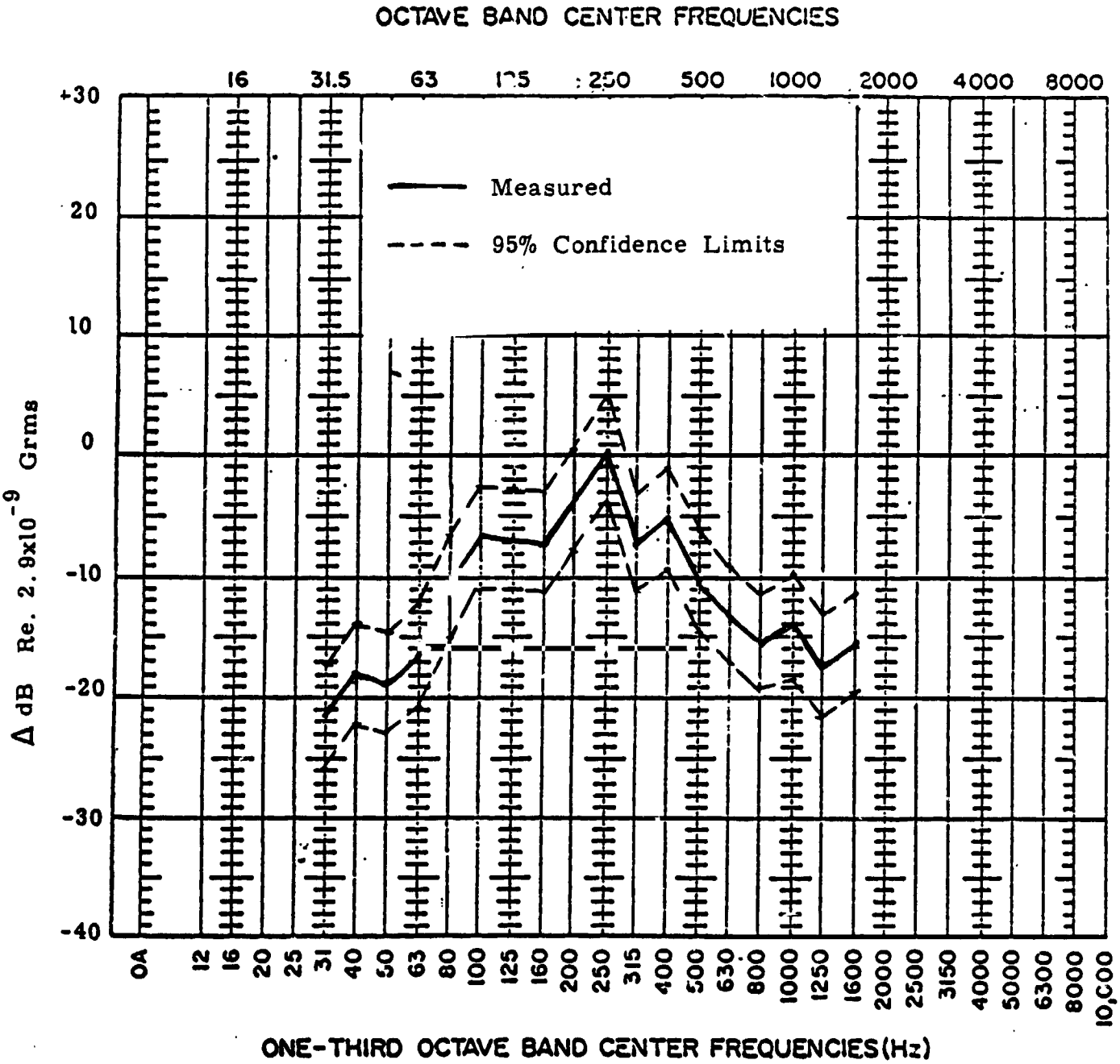


Figure 26 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc · Side of Cold Plate - 9301A
Dir: Normal
Group: ZONE 2

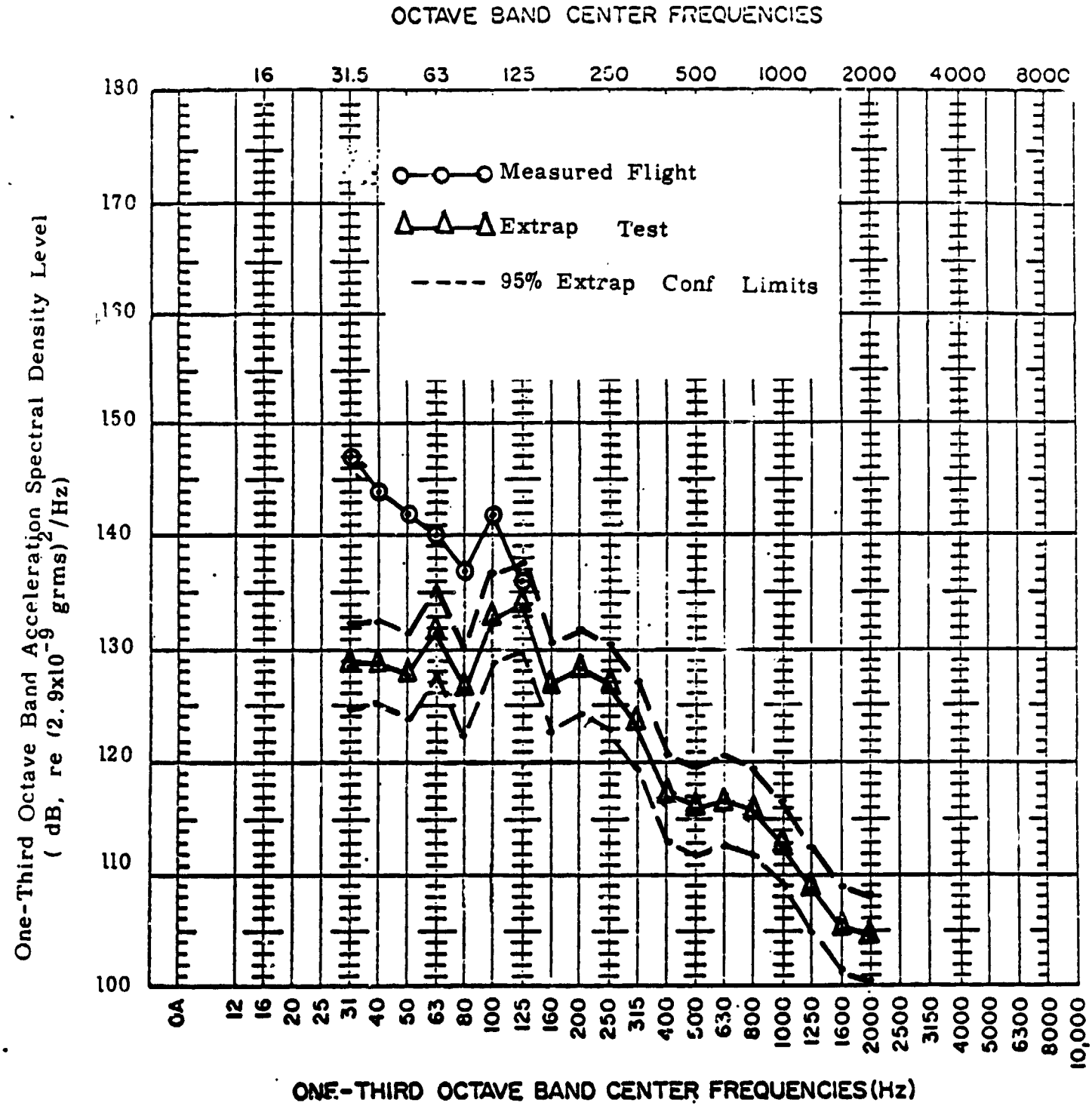


Figure 27 - Measured and Extrapolated Test Acceleration Spectral Density Level
Loc: Aft Side Vertical Platform - 9302A
Dir: X
Group: ZONE 2

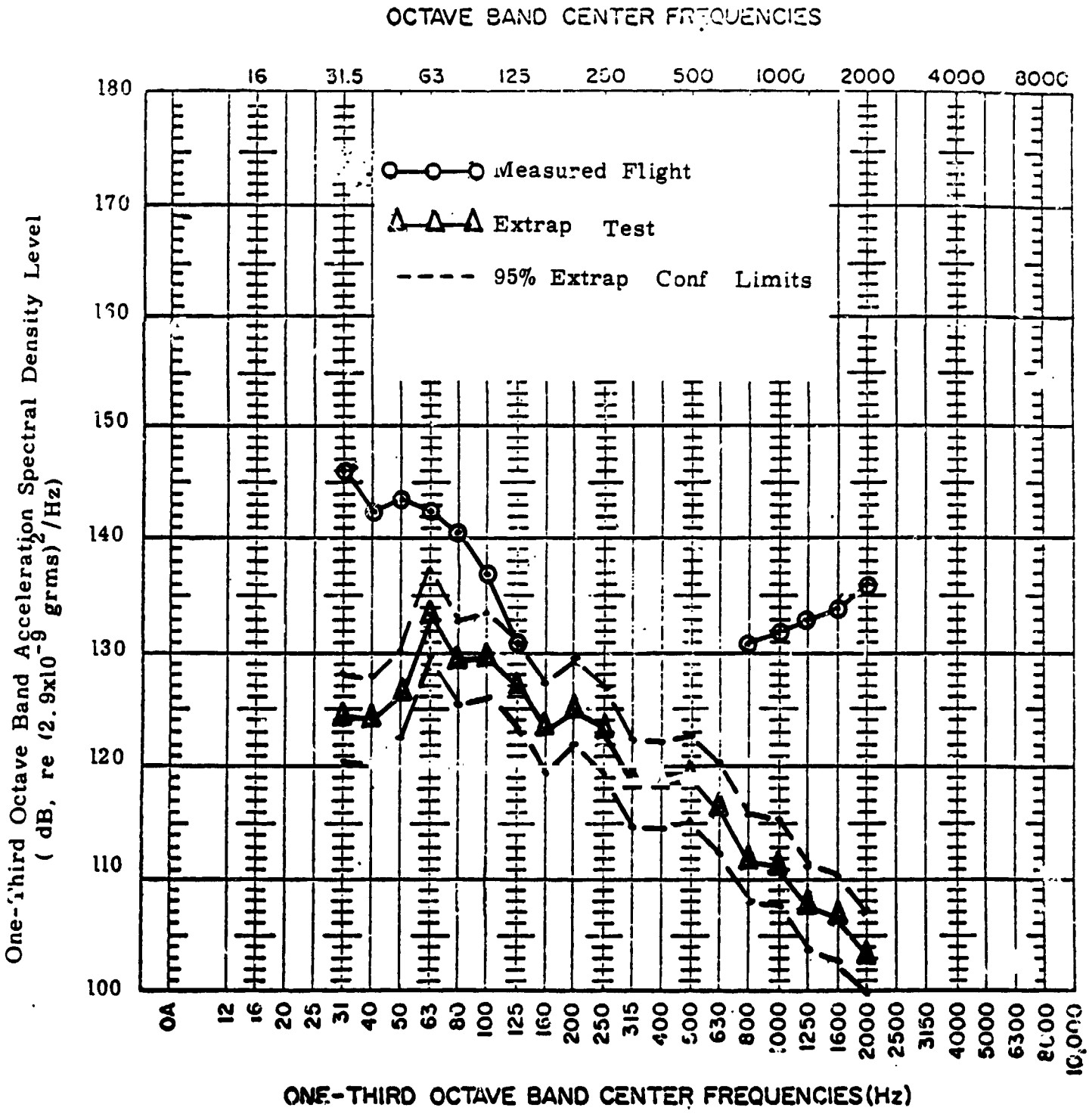


Figure 28 - Measured and Extrapolated Test Acceleration Spectral Density Level
Loc: Aft Side Vertical Platform - 9303A
Dir: Z
Group: ZONE 2

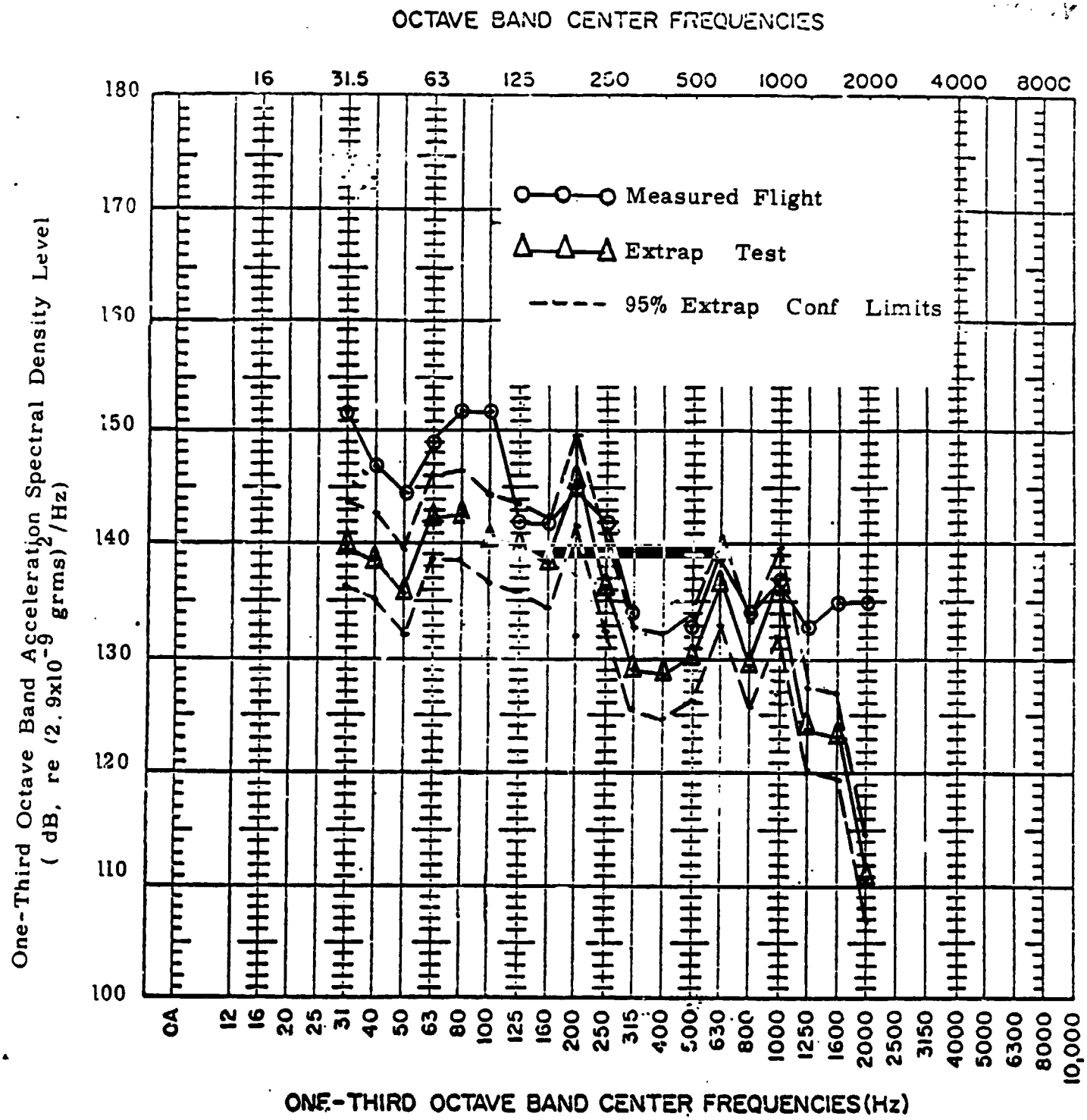


Figure 29 - Measured and Extrapolated Test Acceleration Spectral Density Level
Loc: On Support Bracket for SRPA Instrument - 9294A
Dir: -X
Group: ZONE 3

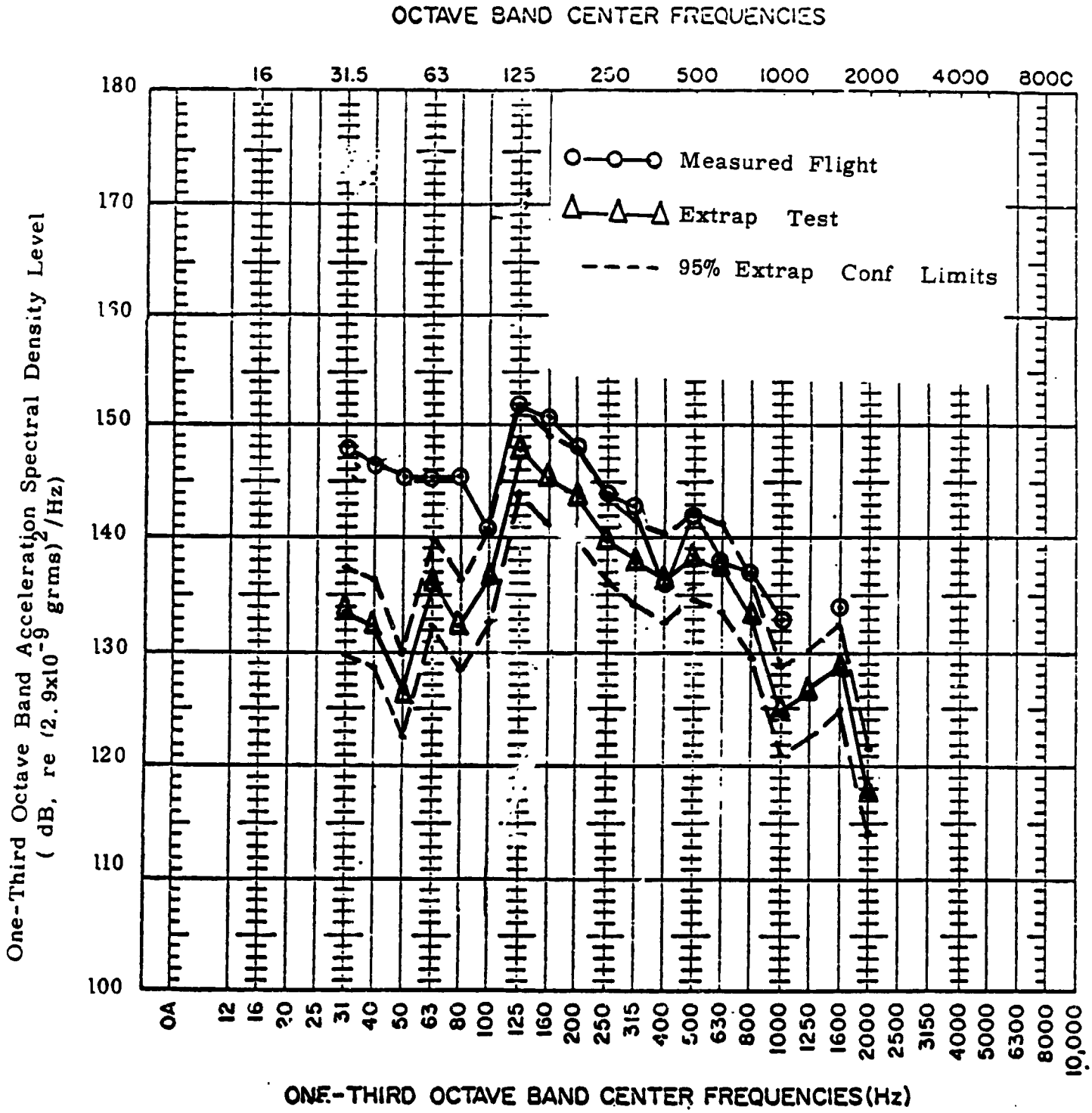


Figure 30 - Measured and Extrapolated Test Acceleration Spectral Density Level
Loc: On Support Bracket for SRPA Instrument - 9295A
Dir: -Z
Group: ZONE 3

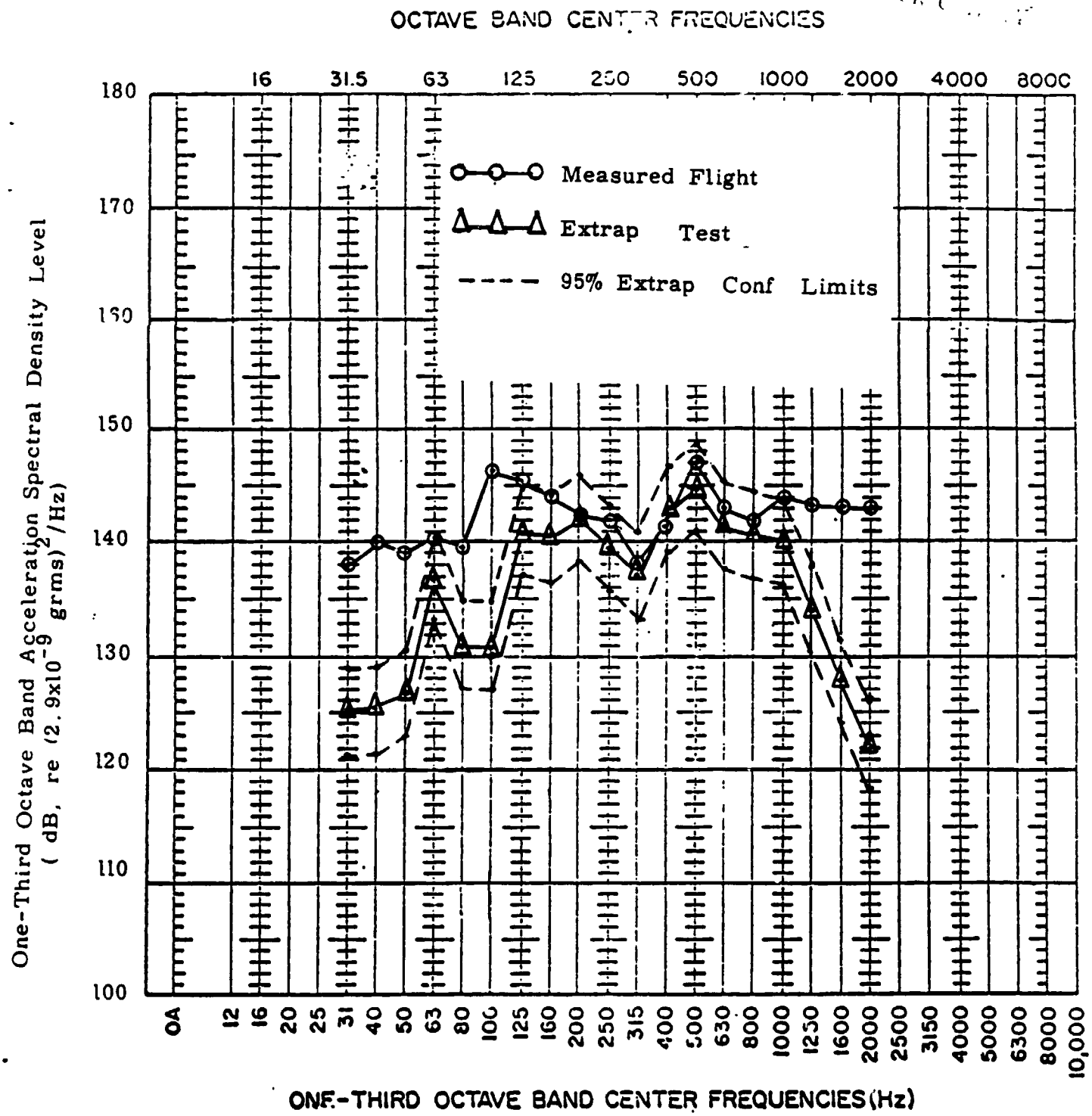


Figure 31 - Measured and Extrapolated Test Acceleration Spectral Density Level
Loc: Panel No 4 Central Insert - 9292A
Dir: X
Group: ZONE 4

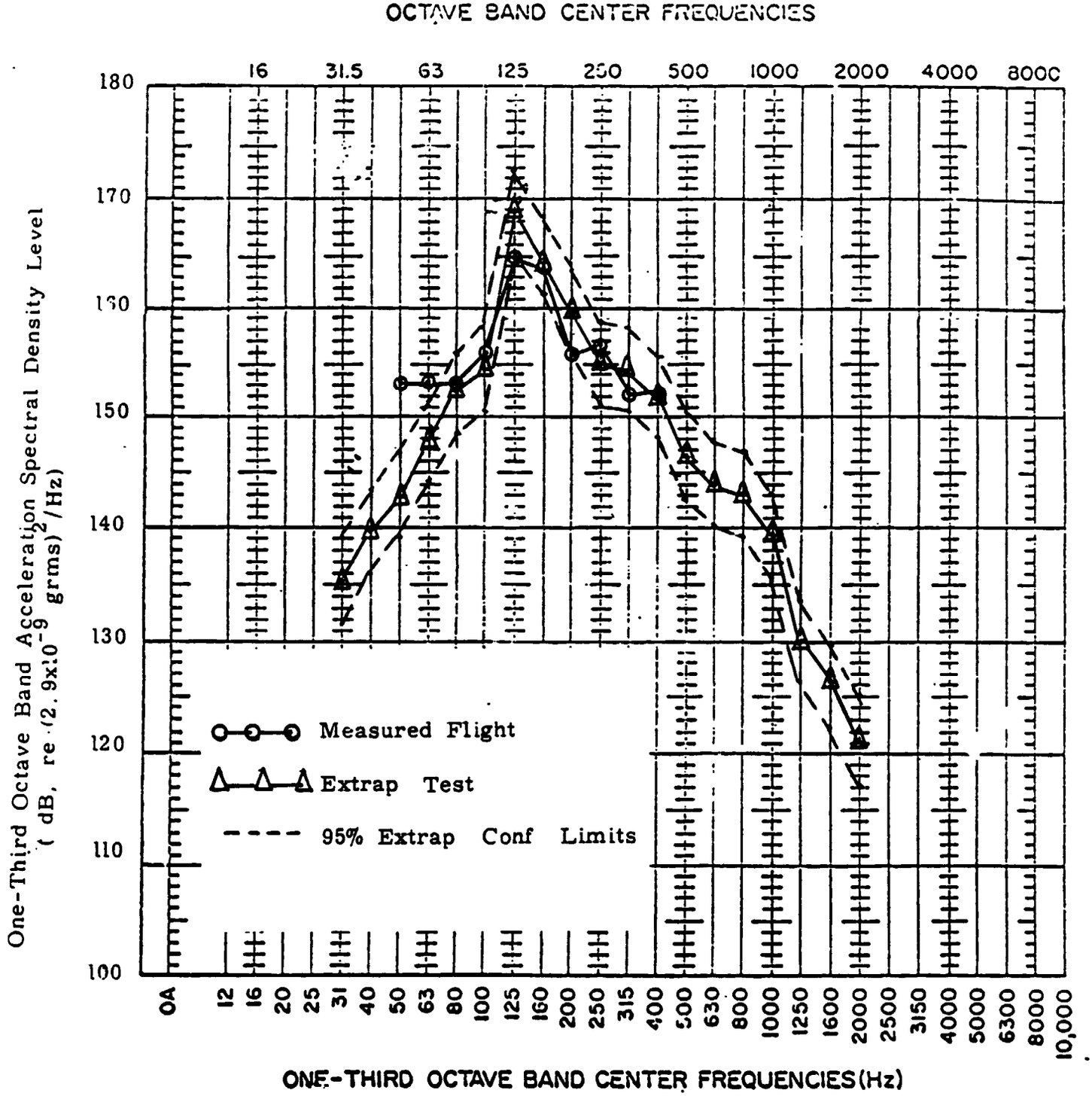


Figure 32 - Measured and Extrapolated Test Acceleration Spectral Density Level
Loc: Panel No 4 Central Insert - 9293A
Dir: Normal
Group: ZONE 4

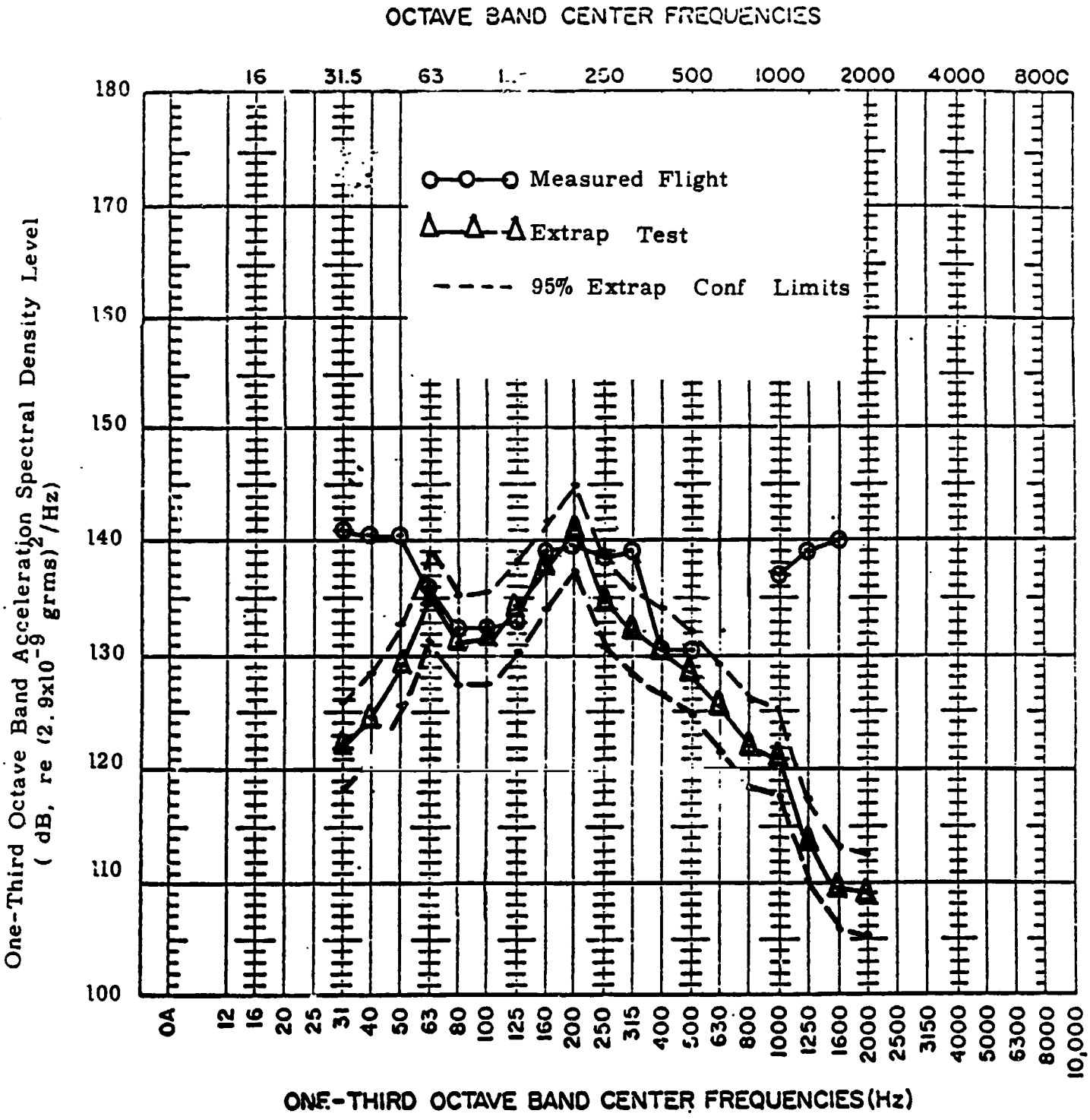


Figure 33 - Measured and Extrapolated Test Acceleration Spectral Density Level
Loc: Aft Side Thermal Canister Base - 9297A
Dir: Z
Group: ZONE 2

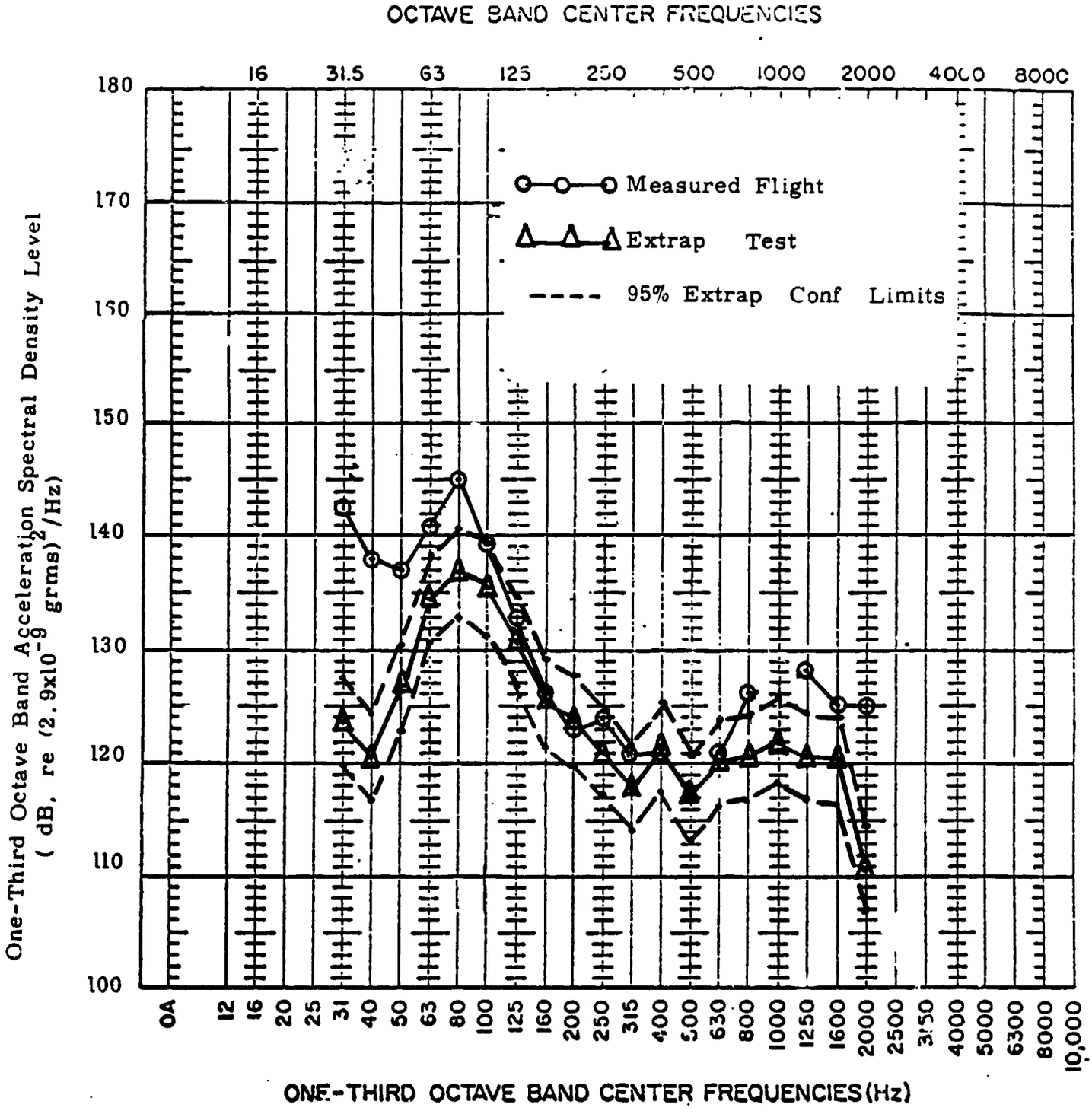


Figure 34 - Measured and Extrapolated Test Acceleration Spectral Density Level
Loc: Inside Thermal Canister Fwd Inbd Corner-9298A
Dir: X
Group: ZONE 3

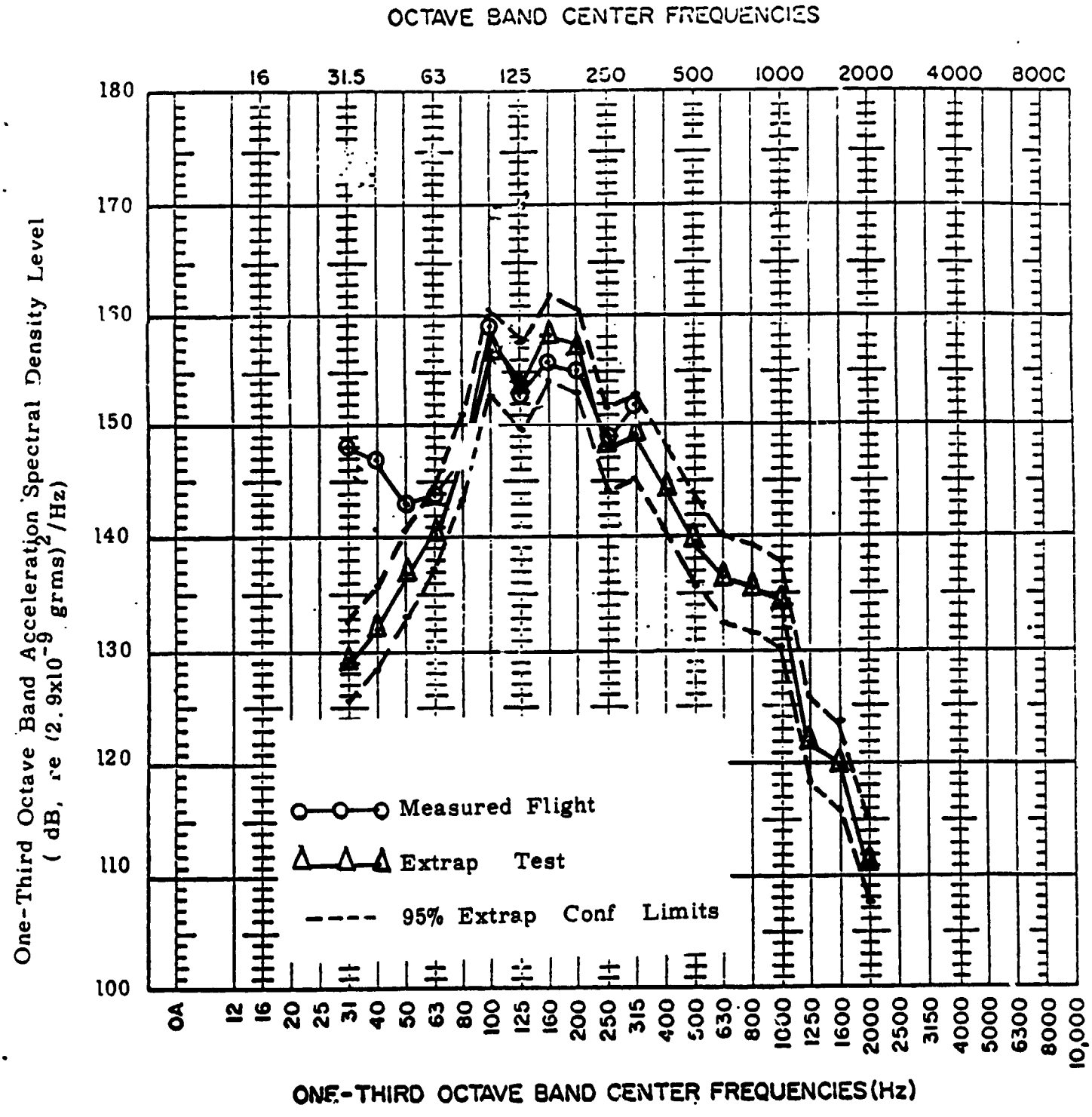


Figure 35 - Measured and Extrapolated Test Acceleration Spectral Density Level
Loc: Aft Inside Thermal Canister - 9299A
Dir: -Y
Group: ZONE 3

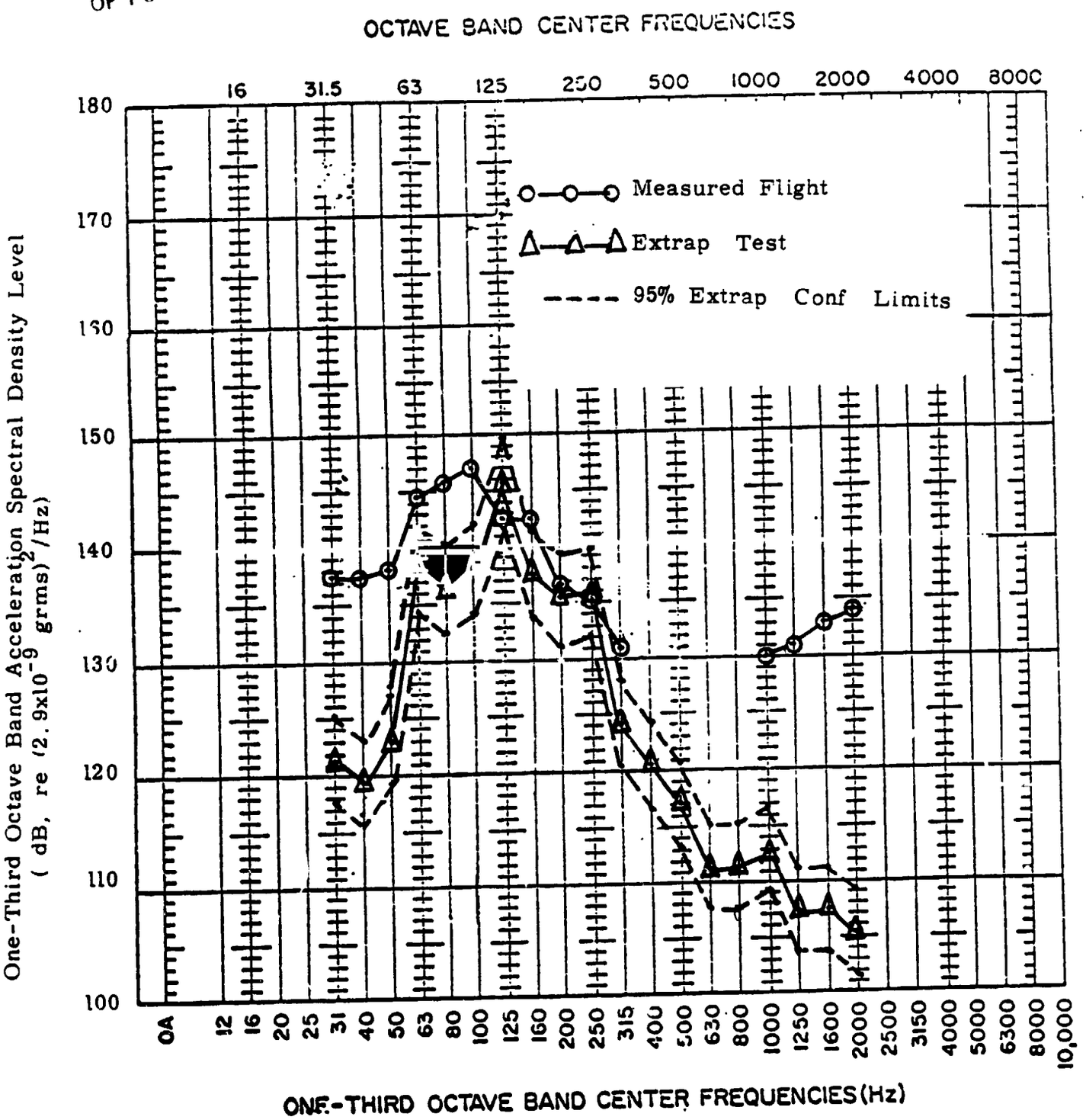


Figure 36 - Measured and Extrapolated Test Acceleration Spectral Density Level
Loc: Side of Cold Plate X Axis - 9300A
Dir: In-plane X
Group: ZONE 2

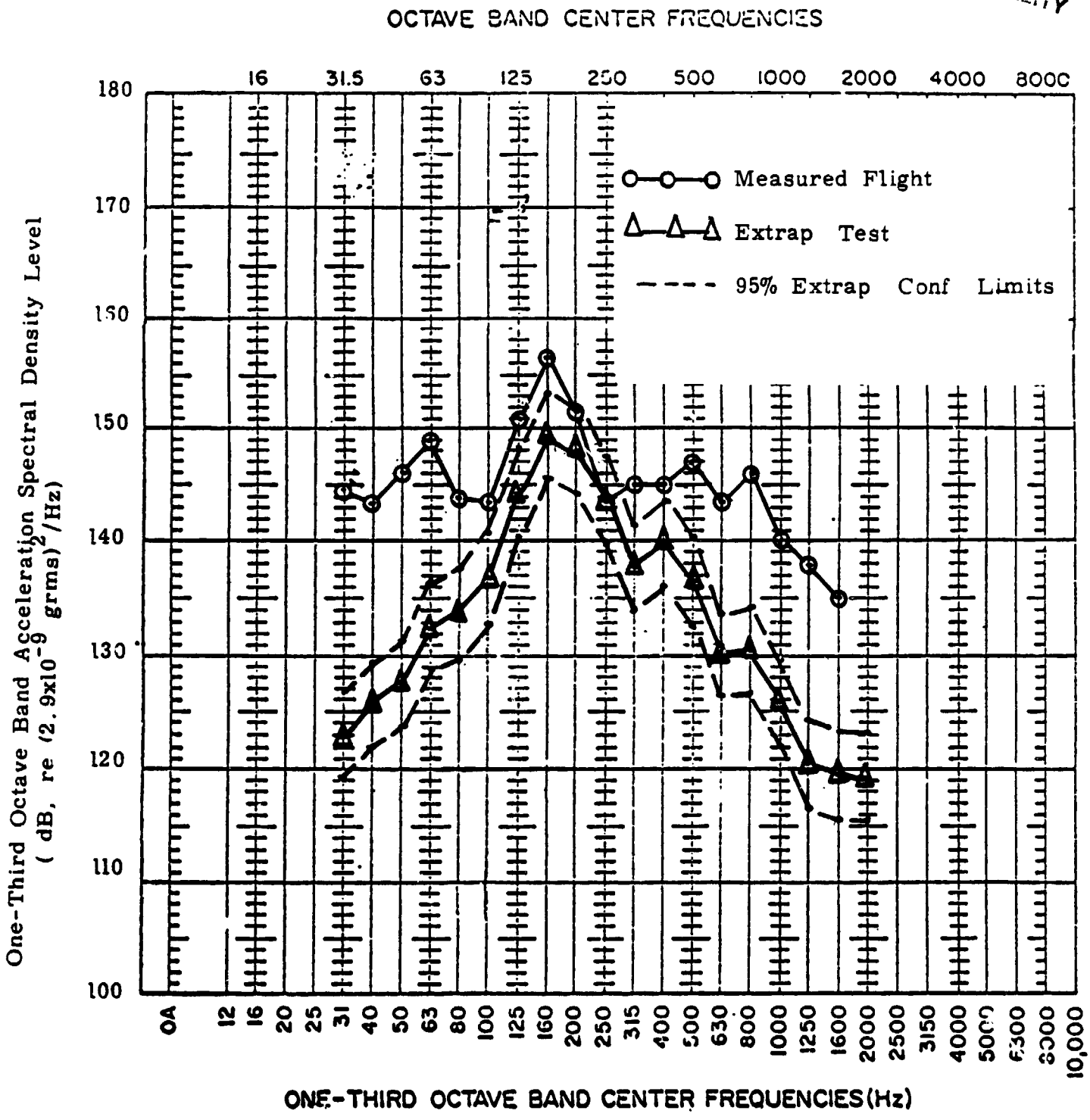


Figure 37 - Measured and Extrapolated Test Acceleration Spectral Density Level
Loc: Side of Cold Plate - 9301A
Dir: Normal
Group: ZONE 2

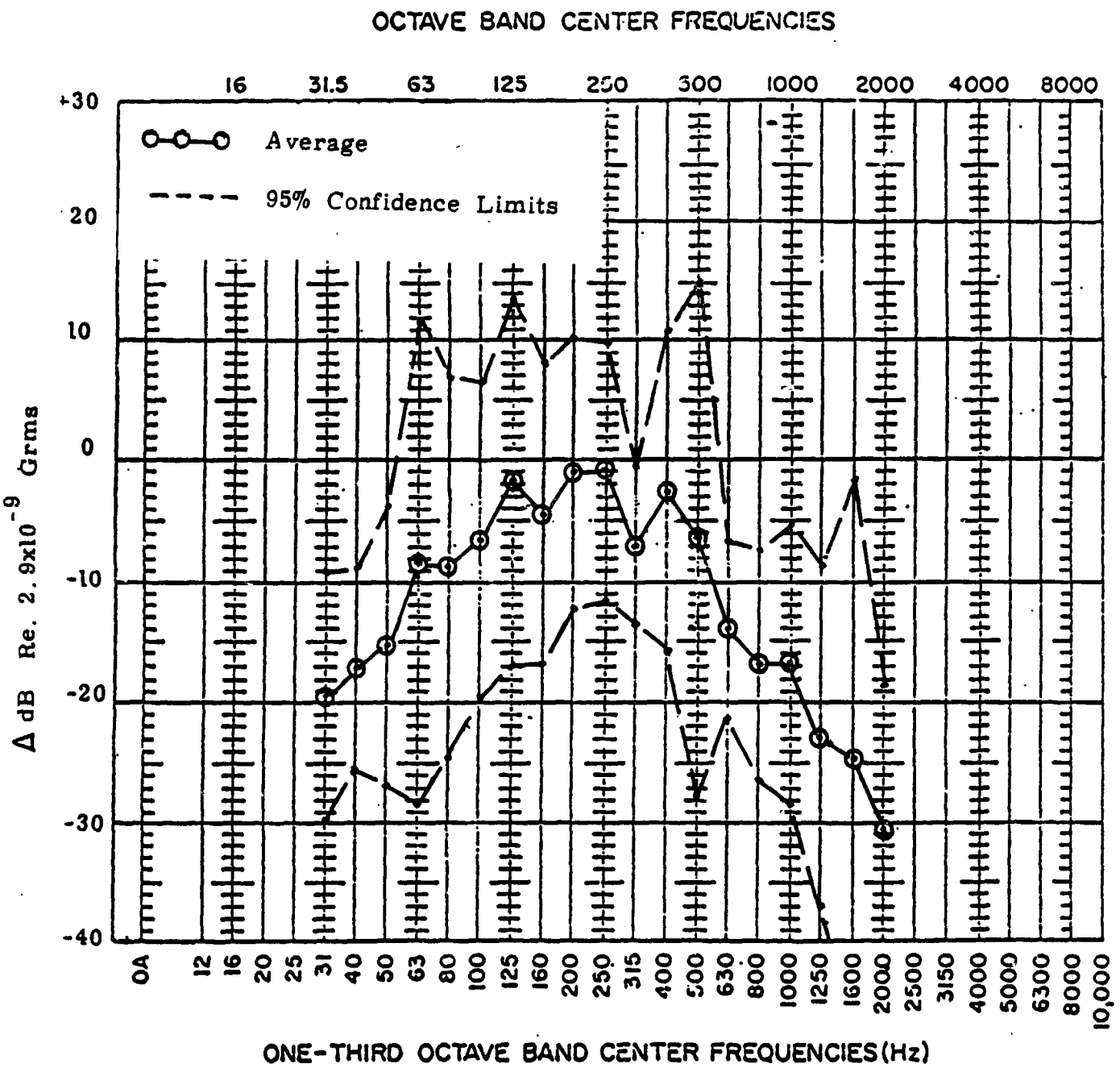


Figure 38 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc · Group· ZONE 2
Dir: All Axes

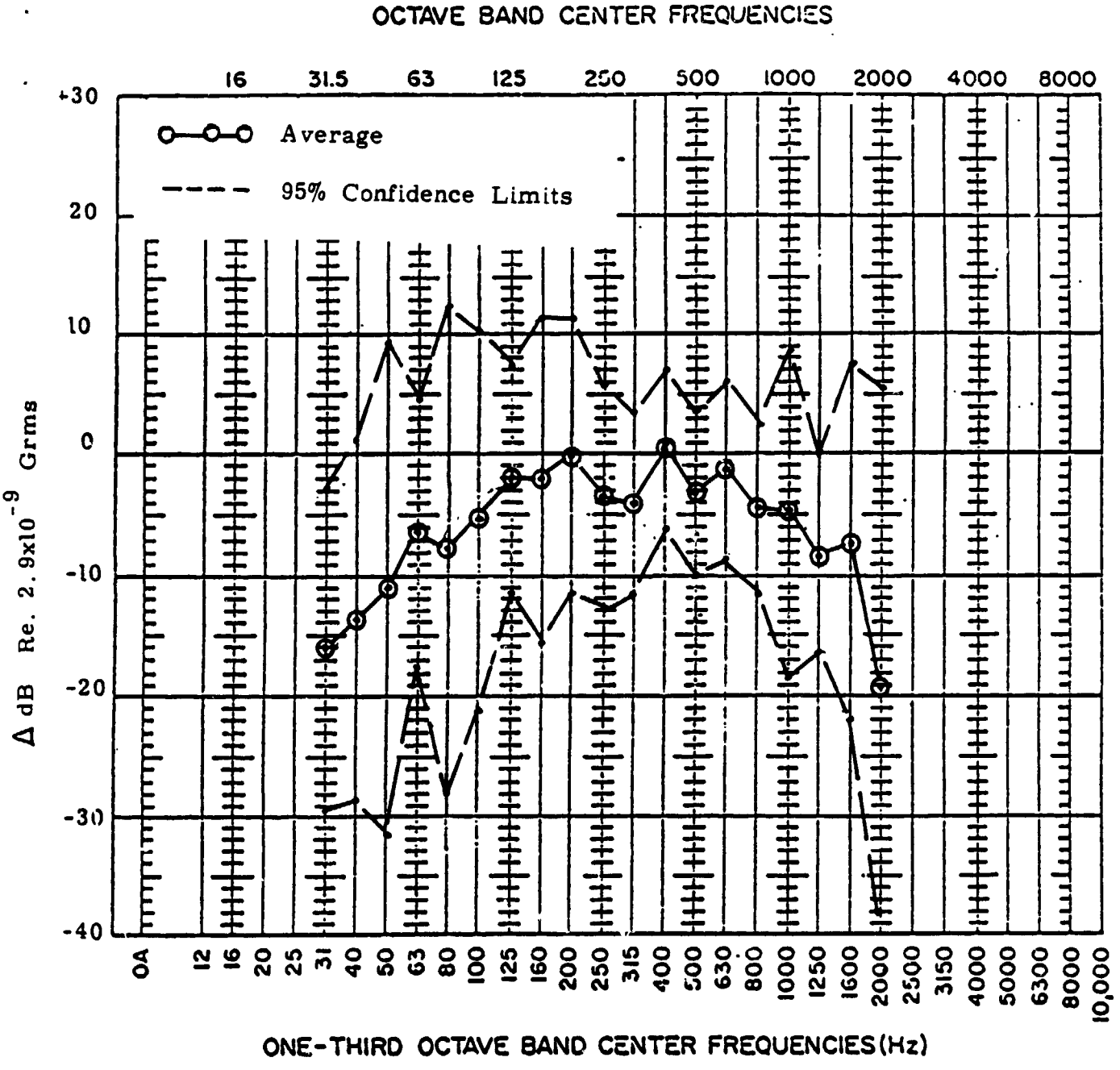


Figure 39 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc - Group - ZONE 3
Dir: All Axes

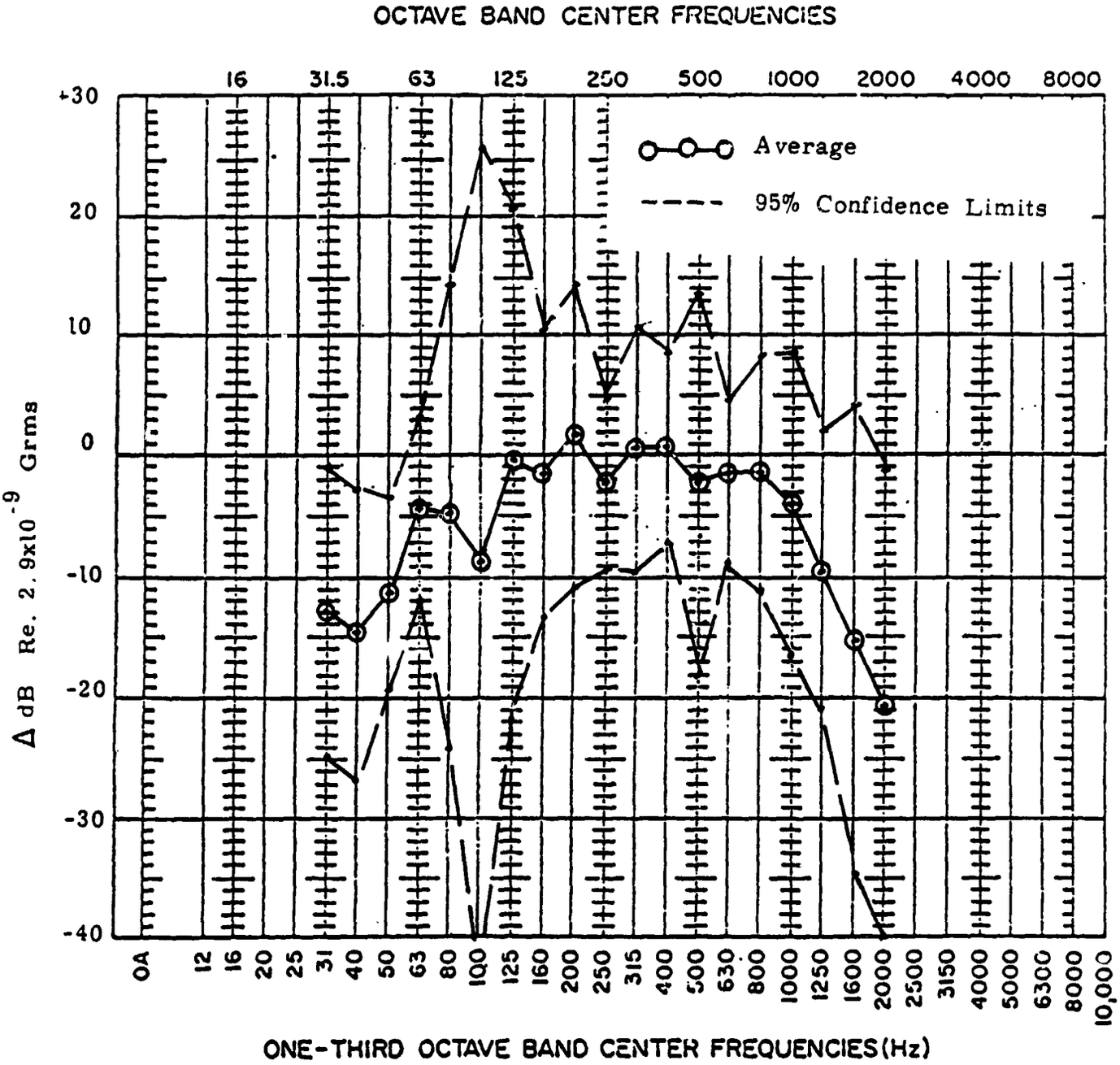


Figure 40 - Acoustic Test Efficiency Factor in One-Third Octave Band Acceleration Level (1/3 OBAL)
Loc · Group· ZONE 4
Dir: All Axes

TABLE 1 - DATE MEASUREMENT INFORMATION ON OSS-1

MICROPHONES

STS-3 MEASUREMENT NO.	TYPE	MEASUREMENT DESCRIPTION	AXIS	RANGE	FREQUENCY RESPONSE	PALLET LOCATION X	Y	Z	TEST DATA ID
V08Y9230A	LFAM	THERMAL CANNISTER INSIDE	OMNI	±0.0918 PSI	5 - 2 KHZ	78	7	452	M1
V08Y9231A	LFAM	THERMAL CAN OUTSD INBD FWD COR	OMNI	±0.2306 PSI	5 - 2 KHZ	59	-10	471	M2
V08Y9232A	LFAM	END LONG BOOM PLAT. 6 FACING AFT	OMNI	±0.2306 PSI	5 - 2 KHZ	87	-35	419	M3
V08Y9233A	HFAM	PLAT. 4 AFT INBD COR FACING AFT	OMNI	±0.2306 PSI	20 - 8 KHZ	32	66	417	M4
V08Y9234A	HFAM	END SHT. BOOM VERT PLAT. FACING FWD	OMNI	±0.2306 PSI	20 - 8 KHZ	3	11	409	M5

HIGH-FREQUENCY ACCELEROMETERS

V08D9292A	HFA	PANEL #4 CTRL INSERT	X	±40 G	5 - 2 KHZ	101	65	392	43
V08D9300A	HFA	SIDE OF COLD PLATE X AXIS	IN PLANE X	±20 G	5 - 2 KHZ	84	-61	390	144
V08D9294A	HFA	ON SUPT BRACKET FOR SRPA INST	-X	±20 G	5 - 2 KHZ	11	52	433	26
V08D9302A	HFA	AFT SIDE VERT PLATFORM	X	±20 G	5 - 2 KHZ	4	51	409	14
V08D9296A *	HFA	AFT SIDE THERM CANN BASE	X	±20 G	5 - 2 KHZ	108	-7	352	133
V08D9298A	HFA	INSD THERM CANN FWD INBD CORNER	X	±20 G	5 - 2 KHZ	72	-5	446	135
V08D9297A	HFA	AFT SIDE THERM CANN BASE	Z	±20 G	5 - 2 KHZ	108	-7	352	134
V08D9299A	HFA	AFT INSIDE THERM CANN	-Y	±40 G	5 - 2 KHZ	72	-5	446	136
V08D9293A	HFA	PANEL #4 CENTRAL INSERT	NORMAL	±40 G	5 - 2 KHZ	101	65	392	44
V08D9301A	HFA	SIDE OF COLD PLATE	NORMAL	±20 G	5 - 2 KHZ	84	-61	390	145
V08D9295A	HFA	ON SUPPORT BRACKET FOR SRPA INST	-Z	±20 G	5 - 2 KHZ	11	52	433	68
V08D9303A	HFA	AFT SIDE VERT PLATFORM	Z	±20 G	5 - 2 KHZ	4	51	409	16

* Bad data channel during flight

TABLE 2

OSS-1 ACOUSTIC ENVIRONMENT
(31.5 Hz - 2K Hz)

Spatial Average 1/3 OB Sound Pressure Level
dB (re 20 $\mu N/m^2$)

1/3 Octave Band Center Frequency Hz	Acoustic Test			STS-3 Lift-Off
	Control Mics	DATE Mics	Mean	
31.5	124.5	123.6	124	114.1
40	125	121.6	123.3	118.1
50	123	121.1	122	121.2
63	125.5	123.4	124.4	123.9
80	125.5	123.6	124.6	123.3
100	126	123.7	124.8	123.9
125	128	126.5	127.2	124.9
160	129	126.4	127.7	124
200	129	128	128.5	124
250	130.5	128.3	129.4	123.6
315	130	126.8	128.4	120.8
400	130	127.2	128.6	118.7
500	130.5	128.3	129.4	117
630	131.5	129.6	130.6	115
800	129.5	127.8	128.6	114.2
1000	126.5	124.5	125.5	113.4
1250	127.5	123.8	125.6	110
1600	125	123.6	124.3	108
2000	124	122.6	123.3	107

TABLE 3

ESTIMATED VARIANCES

1/3 OB Center Frequency (Hz)	Variance σ^2 in dB Ref*					
	Space Average Acoustic (1/3OBSPL)		Acceleration Spectral Density (1/3OBASDL)			Test Efficiency Factor ** Eq. (18)
	Test	Flight	Test	Eq. (15) Extrap. Test	Flight	
31.5 - 63	2.25	1.0	0.25	3.50	0.25	3.75
63 - 200	0.50	3.0	0.25	3.75	0.25	4.00
200 - 2000	0.25	3.0	0.25	3.50	0.25	3.75

* 1/3OBSPL referenced to 20 $\mu N/m^2$

1/3OBASDL referenced to $(2\ 9x10^{-9}\ grms)^2$ /Hz

** Test Efficiency Factor = 1/3OBASDL(Extrap. Test) - 1/3OBASDL(Flight)

= 1/3OBAL(Extrap. Test) - 1/3OBAL(Flight)

TABLE 4

TEST EFFICIENCY FACTOR
OSS-1 PALLET PAYLOAD
1/3OBAL (OB RE 2.0E-9 GRMS)
MEASUREMENT ID V86D 9302A ZONE 2

TEST EFFICIENCY FACTOR

HZ	EXTRAP	MEAS FLT	Meas	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	137.1	155.6	-18.5	-14.8	-22 3
40.0	138.5	153.7	-15.2	-11.5	-19.0
50.0	138.1	152.6	-14 5	-10.0	-10 3
63.0	143.2	151.6	-8 4	-4.6	-12 2
80.0	139.0	149.7	-10.7	-6.0	-14 6
100.0	146.2	155.6	-9.4	-5.5	-13.3
125.0	148.3	150.6	-2.3	1.6	-6.2
160.0	142.4				
200.0	144.7				
250.0	144.3				
315.0	141.0				
400.0	136.5				
500.0	136 4				
630.0	130 3				
800.0	130.5				
1000.0	136.4				
1250.0	133.3				
1600.0	130.7				
2000.0	131 1				
OAL	154.4	161.7			
GRMS	0.15	0.35			

TABLE 5

TEST EFFICIENCY FACTOR
OSS-1 PALLET PAYLOAD
1/3OBAL (DB RE 2.0E-9 GRMS)
MEASUREMENT ID V880 9303A ZONE 2

TEST EFFICIENCY FACTOR

HZ	EXTRAP	MEAS FLT	Meas	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	132.8	154.6	-21.8	-18.1	-25.6
40.0	133.8	152.2	-18.4	-14.7	-22.2
50.0	136.9	154.1	-17.2	-13.5	-21.0
63.0	145.0	154.1	-9.1	-5.3	-12.9
80.0	141.9	153.2	-11.3	-7.4	-15.2
100.0	143.4	150.6	-7.2	-3.3	-11.1
125.0	141.6	145.6	-4.0	-0.1	-7.9
160.0	139.1				
200.0	142.6				
250.0	140.7				
315.0	137.2				
400.0	138.1				
500.0	139.7				
630.0	138.1				
800.0	134.5	153.7	-19.2	-15.4	-23.0
1000.0	135.1	156.6	-20.5	-16.7	-24.3
1250.0	132.2	157.6	-25.4	-21.6	-29.2
1600.0	132.1	159.7	-27.6	-23.0	-31.4
2000.0	129.0	162.6	-34.7	-28.0	-36.5
OAL	152.3	167.2			
GRMS	0.12	0.66			

TABLE 6

TEST EFFICIENCY FACTOR
OSS-1 PALLET PAYLOAD
1/3OBAL (DB RE 2.0E-9 GRMS)
MEASUREMENT ID V880 9294A ZONE 3

TEST EFFICIENCY FACTOR

				95% CONFIDENCE LIMIT	
HZ	EXTRAP	MEAS FLT	Meas	UPPER	LOWER
31.5	148.5	160.5	-12.0	-8.3	-15.8
40.0	148.6	156.7	-8.1	-4.4	-11.9
50.0	146.3	155.1	-8.8	-5.1	-12.6
63.0	153.9	160.6	-6.7	-2.0	-10.5
80.0	155.3	164.7	-9.4	-5.5	-13.3
100.0	154.0	165.6	-11.6	-7.7	-15.5
125.0	154.3	156.6	-2.3	1.6	-6.2
160.0	154.1	157.7	-3.6	0.3	-7.5
200.0	162.4	161.6	0.8	4.7	-3.1
250.0	153.9	159.6	-5.7	-1.9	-9.5
315.0	147.7	152.6	-4.9	-1.1	-8.7
400.0	149.3				
500.0	158.7	153.6	-2.9	6.9	-6.7
630.0	158.4	160.6	-2.2	1.6	-6.0
800.0	152.1	156.7	-4.6	-0.8	-8.4
1000.0	160.4	160.6	-1.2	2.6	-5.0
1250.0	148.4	157.6	-9.2	-5.4	-13.0
1600.0	148.0	160.7	-11.0	-8.0	-15.6
2000.0	137.5	161.6	-24.1	-20.3	-27.9
OAL	167.5	172.0			
GRMS	0.60	1.20			

TABLE 7

TEST EFFICIENCY FACTOR
OSS-1 PALLET PAYLOAD
1/3OBAL (DB RE 2.9E-9 GRMS)
MEASUREMENT IQ_V880 9295A ZONE 3

TEST EFFICIENCY FACTOR

HZ	EXTRAP	MEAS FLT	Meas	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	142.2	156.6	-14.4	-10.7	-18.2
40.0	142.2	156.2	-14.0	-10.3	-17.8
50.0	136.8	156.1	-19.3	-15.6	-23.1
63.0	147.6	157.1	-9.5	-5.8	-13.3
80.0	145.1	158.2	-13.1	-9.2	-17.0
100.0	150.2	154.6	-4.4	-0.5	-8.3
125.0	162.5	166.6	-4.1	-0.2	-8.0
160.0	160.0	166.7	-5.9	-2.0	-9.0
200.0	160.5	164.6	-4.1	-0.2	-8.0
250.0	157.4	161.6	-4.2	-0.4	-8.0
315.0	156.5	161.6	-5.1	-1.3	-8.9
400.0	156.1	155.7	0.4	4.2	-3.4
500.0	150.0	162.6	-3.6	0.2	-7.4
630.0	150.1	150.6	-0.5	3.3	-4.3
800.0	156.0	160.7	-3.0	-0.1	-7.7
1000.0	148.5	156.6	-8.1	-4.3	-11.0
1250.0	151.1				
1600.0	154.3	160.7	-5.4	-1.6	-9.2
2000.0	144.5				
OAL	160.2	173.7			
GRMS	0.03	1.40			

TABLE 8

TEST EFFICIENCY FACTOR
OSS-1 PALLET PAYLOAD
1/3OBAL (DB RE 2.0E-0 GRMS)
MEASUREMENT ID V080 9292A ZONE 4

TEST EFFICIENCY FACTOR

				95% CONFIDENCE LIMIT	
HZ	EXTRAP	MEAS FLT	Meas	UPPER	LOWER
31.5	133.7	146.6	-12.9	-9.1	-16.7
40.0	135.0	149.7	-14.7	-11.0	-18.5
50.0	137.4	149.6	-12.2	-8.4	-16.0
63.0	148.5	152.1	-3.6	0.2	-7.3
80.0	143.7	152.2	-8.5	-4.6	-12.4
100.0	144.4	160.1	-15.7	-11.0	-19.6
125.0	155.5	160.1	-4.6	-0.7	-8.5
160.0	156.2	159.7	-3.5	0.4	-7.4
200.0	158.8	159.2	-0.4	3.5	-4.3
250.0	157.0	159.6	-2.6	1.2	-6.4
315.0	155.6	156.6	-1.0	2.0	-4.0
400.0	162.6	161.2	1.4	5.2	-2.4
500.0	165.4	167.6	-2.2	1.6	-6.0
630.0	163.1	164.6	-1.5	2.3	-5.3
800.0	163.3	164.7	-1.4	2.4	-5.2
1000.0	163.0	167.0	-4.0	-0.2	-7.0
1250.0	158.7	160.1	-0.4	-5.0	-13.2
1600.0	153.4	160.7	-10.2	-11.5	-19.1
2000.0	140.0	160.0	-20.7	-16.0	-24.5
OAL	171.0	176.0			
GRMS	1.14	2.00			

TABLE 9

TEST EFFICIENCY FACTOR
OSS-1 PALLET PAYLOAD
1/3OBAL (DB RE 2.0E-9 GRMS)
MEASUREMENT ID V880 9293A ZONE 4

TEST EFFICIENCY FACTOR

HZ	EXTRAP	MEAS FLT	Meas	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	143.9				
40.0	149.5				
50.0	153.4	163.8	-10.4	-6.6	-14.2
63.0	159.6	164.8	-5.2	-1.4	-8.9
80.0	164.9	165.9	-1.0	2.9	-4.9
100.0	168.0	169.6	-1.6	2.3	-5.5
125.0	183.4	179.6	3.8	7.7	-0.1
160.0	188.2	179.7	8.5	4.4	-3.4
200.0	176.4	172.4	4.0	7.9	0.1
250.0	172.6	174.3	-1.7	2.1	-5.5
315.0	173.1	178.0	2.3	6.1	-1.5
400.0	171.6	171.9	-0.3	3.5	-4.1
500.0	167.1				
630.0	165.6				
800.0	165.0				
1000.0	163.0				
1250.0	154.6				
1600.0	151.0				
2000.0	147.0				
OAL	166.5	164.4			
GRMS	6.12	4.01			

TABLE 10

TEST EFFICIENCY FACTOR
OSS-1 PALLET PAYLOAD
1/3OBAL :DB RE 2.9E-9 GRMS)
MEASUREMENT ID V08O 9297A ZONE 2

TEST EFFICIENCY FACTOR

HZ	EXTRAP	MEAS FLT	Meas	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	138.7	148.6	-10.9	-15.2	-22.7
40.0	134.4	150.2	-15.8	-12.1	-19.6
50.0	139.8	151.1	-11.3	-7.6	-15.1
63.0	146.6	147.6	-1.0	2.8	-4.8
80.0	143.9	145.2	-1.3	2 6	-5.2
100.0	145.0	146.1	-1.1	2.8	-5.0
125.0	148.9	147.6	1.2	5.1	-2.7
160.0	153.6	154.7	-1.1	2.8	-5.0
200.0	157.0	156.2	1.6	5.5	-2.3
250.0	152.3	156.1	-3.0	0.0	-7.6
315.0	150.7	157.6	-6.9	-3.1	-10.7
400.0	150.0	150.2	-0.2	3.6	-4.0
500.0	149.0	151.1	-2.1	1.7	-5.9
630 0	147.0	161.6	-14.6	-10.0	-10.4
800.0	144.0	160.7	-16.0	-12.1	-19.7
1000.0	145.0	160.0	-15.6	-11.0	-19.4
1250.0	130.4	163.0	-26.2	-21.4	-29.0
1600.0	135.2	165.7	-30.5	-26.7	-34.3
2000.0	135.0				
OAL	162.1	170.0			
GRMS	0.37	1.01			

TABLE 11

TEST EFFICIENCY FACTOR

OSS-1 PALLET PAYLOAD

1/3OBAL (OB RE 2.0E-0 GRMS)

MEASUREMENT ID V090 9298A ZONE 3

TEST EFFICIENCY FACTOR

HZ	EXTRAP	MEAS FLT	Meas	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	132.2	151.1	-18.9	-15.2	-22.7
40.0	138.3	147.7	-17.4	-13.7	-21.2
50.0	137.3	147.6	-10.3	-6.6	-14.1
63.0	146.1	152.6	-6.5	-2.8	-10.3
80.0	149.6	157.7	-8.1	-4.2	-12.0
100.0	148.8	152.6	-3.8	0.1	-7.7
125.0	145.3	147.6	-2.3	1.6	-6.2
160.0	141.1	141.7	-0.6	3.3	-4.5
200.0	140.5	139.6	0.9	4.8	-3.0
250.0	138.6	141.6	-3.0	0.8	-6.0
315.0	136.5	139.6	-3.1	0.7	-6.9
400.0	141.1	140.7	0.4	4.2	-3.4
500.0	137.7				
630.0	141.6	142.6	-1.0	2.0	-4.0
800.0	143.2	148.7	-5.6	-1.7	-9.3
1000.0	145.6	150.6	-5.0	-1.2	-9.0
1250.0	145.4	152.6	-7.2	-3.4	-11.0
1600.0	146.0	150.7	-4.0	-1.0	-0.6
2000.0	137.4	151.6	-14.2	-10.4	-10.0
OAL	150.6	162.0			
GRMS	0.20	0.41			

TABLE 12

TEST EFFICIENCY FACTOR
OSS-1 PALLET PAYLOAD
1/3OBAL (DB RE 2.0E-9 GRMS)
MEASUREMENT ID V88D9299A ZONE 3

TEST EFFICIENCY FACTOR

HZ	EXTRAP	MEAS FLT	Meas	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	137.8	156.6	-18.8	-15.1	-22.6
40.0	141.8	156.7	-14.9	-11.2	-18.7
50.0	147.5	153.6	-6.1	-2.3	-9.8
63.0	152.5	155.6	-3.1	0.7	-6.8
80.0	159.0	159.7	0.2	4.1	-3.7
100.0	178.3	172.6	-2.3	1.6	-6.2
125.0	168.1	167.6	0.5	4.4	-3.4
160.0	173.7	171.7	2.0	5.9	-1.9
200.0	173.6	171.6	2.0	5.9	-1.9
250.0	165.6	166.6	-1.0	2.8	-4.8
315.0	167.5	170.6	-3.1	0.7	-6.9
400.0	164.0				
500.0	160.1				
630.0	157.9				
800.0	158.2				
1000.0	157.7				
1250.0	146.6				
1600.0	146.5				
2000.0	139.1				
OAL	170.8	170.6			
GRMS	2.50	2.46			

TABLE 13

TEST EFFICIENCY FACTOR
OSS-1 PALLET PAYLOAD
1/3OBAL (DB RE 2.0E-0 GRMS)
MEASUREMENT ID V080 9300A ZONE 2

TEST EFFICIENCY FACTOR

HZ	EXTRAP	MEAS FLT	Meas	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	138.8	146.1	-16.1	-12.4	-19.9
40.0	129.8	147.2	-18.2	-14.5	-22.8
50.0	133.6	148.6	-15.0	-11 3	-18.8
63.0	149.7	156.1	-6.4	-2.6	-10.2
80.0	149.0	158.7	-9.7	-5.0	-13.6
100.0	151.0	160.0	-8.0	-4.0	-12.7
125.0	160.3	157.1	3.2	7.1	-0.7
160.0	153.2	158.2	-5.0	-1.1	-8.9
200.0	151.9	153.2	-1.3	2 6	-5.2
250.0	153.5	152.6	0.9	4.7	-2.9
315.0	142.7	149.6	-6.9	-3.1	-10.7
400.0	140.1				
500.0	137.7				
630.0	133.0				
800 0	134.1				
1000.0	150.3	160.6	-17.1	-13.3	-20.0
1250.0	132.0	160.6	-23.6	-10.0	-27.4
1600.0	133.2	150.7	-20.0	-21.7	-20.3
2000.0	132.1	160.6	-20.5	-24.7	-32.3
OAL	163.1	160.2			
GRMS	0.41	0:75			

TABLE 14

TEST EFFICIENCY FACTOR
OSS-1 PALLET PAYLOAD
1/3OBAL JDB RE 2.0E-9 GRMS)
MEASUREMENT ID V88D9301A ZONE 2

TEST EFFICIENCY FACTOR

HZ	EXTRAP	MEAS FLT	Meas	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	131.5	153.1	-21.6	-17.9	-25.4
40.0	135.4	153.2	-17.8	-14.1	-21.6
50.0	138.1	156.6	-18.5	-14.8	-22 3
63.0	144.2	160.6	-16.4	-12.7	-20.2
80.0	146.4	156.7	-10.3	-6.4	-14.2
100.0	150.4	157.1	-6.7	-2.8	-.8.6
125.0	159.8	165.6	-5.8	-1.9	-9.7
160.0	165.1	172.2	-7 1	-3.2	-11 8
200.0	164 6	168.2	-3.6	8 3	-7.5
250.0	161.2	161.1	0.1	3.9	-3 7
315.0	156.4	163.6	-7.2	-3.4	-11.0
400.0	150.6	164.7	-5.1	-1.3	-8.0
500.0	157.1	167.6	-10.5	-6.7	-14.3
630 0	151.7	166.1	-13.4	-9.6	-17.2
800.0	153.2	168.7	-15.5	-11.7	-19.3
1000.0	149.5	163.6	-14.1	-10.3	-17.9
1250.0	145.0	162.6	-17.6	-13.8	-21.4
1600.0	145.2	160.7	-15.5	-11.7	-19.3
2000.0	146.1				
OAL	170.4	177.0			
GRMS	0.06	2.21			

TABLE 15

PAYLOAD COMPONENT MOUNTING ZONE

ZONE	MEASUREMENT DESCRIPTION	MEASUREMENT No. V08D___
1	NA	NA
2	Side of Cold Plate X-Axis	9300A
	Aft Side Vertical Platform	9302A
	Aft Side Therm. Canister Base	9297A
	Side of Cold Plate	9301A
	Aft Side Vertical Platform	9303A
3	On Support Bracket for SRPA Instrument	9294A
	Inside Therm. Canister Fwd Inbd Corner	9298A
	Aft Inside Thermal Canister	9299A
	On Support Bracket for SRPA Instrument	9295A
4	Panel No. 4 Central Insert	9292A
	Panel No. 4 Central Insert	9293A

TABLE 16

TEST EFFICIENCY FACTOR

OSS-1 PALLET PAYLOAD

1/3OBAL (DB RE 2.9E-9 GRMS)

ZONE 2

			95% CONFIDENCE LIMIT	
HZ	AVERAGE	VARIANCE	UPPER	LOWER
31.5	-10.4	8.4	-0.8	-20.8
40.0	-17.1	6.0	-8 8	-25.4
50.0	-15 3	11 4	-3.8	-26 8
63.0	-8.3	34.6	11 7	-28 3
80.0	-8 7	21 4	7 0	-24 4
100.0	-6.6	14 9	6 5	-19 7
125.0	-1 7	28.1	13 6	-17 0
160 0	-4.4	13 4	8 1	-16.9
200 0	-1.1	10 9	10 1	-12 3
250 0	-0 9	10 1	9 0	-11.7
315 0	-7 0	3.0	-0 4	-13 6
400.0	-2.6	15.0	10.9	-16.1
500.0	-6.3	39 1	15	-27 6
630.0	-14.0	4.5	-6.0	-21.2
800.0	-16 9	7.0	-7.3	-26.5
1000.0	-16.0	11.3	-5.4	-20.2
1250.0	-22.0	17.2	-0.0	-37.0
1600.0	-24.0	46.2	-1.7	-47.0
2000.0	-30.6	12.6	-10.5	-42.7

TABLE 17

TEST EFFICIENCY FACTOR

OSS-1 PALLET PAYLOAD

1/3OBAL (DB RE 2.9E-9 GRMS)

ZONE 3

HZ	AVERAGE	VARIANCE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	-16.0	15.4	-2.7	-29.3
40.0	-13.6	19 3	1.3	-28.5
50.0	-11 1	36 5	9.4	-31 6
63 0	-6.4	18.7	4.7	-17 5
80.0	-7.6	35.6	12.7	-27.9
100.0	-5.5	21 3	10.2	-21.2
125.0	-2.0	7 7	7.4	-11 4
160.0	-2.0	16.0	11 6	-15.6
200.0	-0.1	11 5	11.4	-11.6
250.0	-3.5	7.7	5.9	-12.9
315.0	-4.0	5.0	3.6	-11 6
400.0	0.4	3.0	7.0	-6.2
500.0	-3.2	4.0	3.6	-10.0
630.0	-1.2	4.6	6.1	-8.5
800.0	-4 7	4.4	2.4	-11 0
1000.0	-4.0	15.7	0.7	-10.3
1250.0	-0.2	5.0	0.0	-10.4
1600.0	-7.3	10.0	7.4	-22.0
2000.0	-10.2	52.0	5 5	-43.0

TABLE 18

TEST EFFICIENCY FACTOR

OSS-1 PALLET PAYLOAD

1/3OBAL (DB RE 2.9E-9 GRMS)

ZONE 4

			95% CONFIDENCE LIMIT	
HZ	AVERAGE	VARIANCE	UPPER	LOWER
31.5	-12.9	12.4	-1.8	-24 8
40.0	-14.7	12.6	-2 7	-26.7
50 0	-11.3	5 4	-3.4	-19.2
63 0	-4.4	5 1	3.2	-12 8
80 0	-4.8	32 2	14 5	-24 1
100.0	-8.6	103.5	26 0	-43.2
125.0	-0 4	30.4	20 9	-21.7
160.0	-1.5.	12.1	10.3	-13.3
200:0	1.8	13.8	14.4	-10.8
250.0	-2.2	4 2	4.8	-9.2
315.0	0.6	9.2	10.9	-9.7
400.0	0.6	5.2	8.4	-7.2
500.0	-2.2	21.6	13.6	-18 0
630.0	-1.5	4.6	5.0	-8.0
800.0	-1.4	8 2	8.3	-11 1
1000.0	-4.0	13.5	8.5	-16.5
1250 0	-0.4	11.5	2.1	-20.9
1600.0	-15.3	32.5	4.1	-34.7
2000.0	-20.7	7..7	-1.3	-40.1

APPENDIX A

Description of NASA - GSFC OSS-1 Payload System Level Acoustic Test

Description of NASA-GSFC OSS-1 Payload System Level Acoustic Test

INTRODUCTION

The system level acoustic test of the completely integrated OSS-1 pallet payload was conducted in the 40,000 cubic foot acoustic noise test facility at the GSFC in Greenbelt, MD. The objective of the test was to obtain test data for the following:

a. Random vibration loads/analysis verification and safety of the OSS-1 pallet payload subsystems, components, and support structures.

b. Checkout of the GSFC low-frequency accelerometers.

c. Support random vibration environment studies for other payloads via the extrapolation of data fed into the VAPEPS data base system.

d. Pre-flight evaluation of DATE instrumentation.

e. Acquisition of data to expand test data base information for the ESA pallet.

OSS-1 PAYLOAD TEST CONFIGURATION

All instruments and componets on the OSS-1 payload, except two, are mounted on support structure XY plane platforms No. 1 through 6. Platform No. 1 is forward, mid way between the pallet deck and sills, and supports a YZ "vertical platform". Platform No. 2 is at deck level. Platforms No. 3 through 6 are small "sill shelves", one at each corner of the pallet. The platforms are supported at hardpoints and trunnion fittings. Two components, the MSFC and the University of Iowa electronics, attach to pallet frames and longerons on cold plate support structures.

During the tests, the payload was in flight configuration which included the thermal blankets. Tables A-1 and A-2 present a list of the instrument acronyms and weight breakdown summary.

TEST DESCRIPTION

The OSS-1 pallet payload was suspended in the GSFC 40K cubic foot reverberant acoustic test chamber (figure A-1) using the crane and pallet handling sling (figure A-2) which interfaces the pallet at the four trunnion fittings. Input control microphones were placed around the pallet payload about 2 or 3 feet from it. One was positioned above the payload, one below it and one at each of the four sides. The input test level was considered to be the average of these six microphone levels. The large pallet transport dolly remained in the acoustic chamber during the tests. For each test run, the pallet was lifted 4 or 5 feet from this dolly, then lowered back at the conclusion of the run.

The tests were run at six different input levels - from 130 to 141.5 dB in overall level. Instrumentation included the input control microphones, several microphones on the pallet, strain gages on the Instrument Support Structure and numerous accelerometers on the pallet, the structure, and instruments. All of the data were recorded and most were reduced for all of the test runs. Table A-3 shows the run summary for the test program.

Table A-4 shows the nominal input acoustic level specified for each of the first four test runs. Note that each test run is specified by the same spectrum shape except for different overall levels. The acoustic spectrum for each of the test levels was generated with the chamber empty. All adjustments and settings were noted so that the spectrum may be repeated when the test item is in the chamber. If the spectrum is different (with test item in the chamber) from the empty chamber spectrum, some modification of the spectrum shapes was made to correct the effect of the test article in the chamber. The same procedure was used in test runs 5, 6a and 6b but were performed at the higher overall levels as shown in table A-3.

INSTRUMENTATION

Total instrumentation consisted of 158 accelerometers, 11 microphone and 28 strain gages. Eight of the accelerometer channels were recorded via the C&DH and PSTE system and 150 were recorded by the facility as well as all of the strain gages and microphones. All of the data were recorded on magnetic tape. The average acoustic level was recorded in addition to the individual microphones.

DATA REDUCTION

Test data were reduced during the test program and following its completion. The types of data reduction were as follows:

a. Microphones

   (1) 1/3 Octave Band Plots
   (2) Oscillograph

b. Accelerometers

   (1) PSD Plots - 4 Hz Bandwidth Filter
   (2) Oscillograph
   (3) PSD Table - 1/3 Octave Band Filter

c. Strain Gages

   (1) PDS Plots - 4 Hz Bandwidth Filter
   (2) Oscillograph

The 1/3 octave band filter PSD's were generated by summing the 4Hz narrow band g^2 values over each 1/3 octave bandwidth to provide 1/3 octave band values which were then divided by the corresponding 1/3 octave bandwidth.

All reduced data are filed in Code 731.

TABLE A-1

Experiment / Component Location and Acronyms

Platform #1

University of Iowa Plasma Diagnostic Package (PDP)

Univeristy of Columbia Solar Flare X Ray Polarimeter (COL)

St. University of New York Telescope (SUNY T/S)

Vertical Platform

University of Columbia Electronics (COL E)

Naval Research Lab Solar UV Spectral Irradiance Monitor (SUSIM)

St. University of New York Electronics (SUNY E)

Platform #2

The GSFC Command and Data Handling Box (C&DH)

The GSFC Thermal Canister Experiment (TCE)

Sill Shelf #3

University of Utah Charge Current Probe (CCP-1)

University of Utah Digital Control and Interface Unit (DCIU)

University of Utah Fast Pulse Electron Gun (FPEG)

Sill Shelf #4

University of Utah Spherical Retarding Potential Analyzer (SRPA)

Sill Shelf #5

University of Utah Charge Current Probe (CCP-2)

Sill Shelf #6

University of Iowa RF Antenna (RFA)

TABLE A-2

OSS-1 Payload Chargeable Weight Breakdown

(1)	Pallet Structure:		
	Pallet		1163 lbs.
	Primary Fittings		91
	Secondary Fittings		79
	Hardpoints		63
	MSFC Systems		422
	Keel Fitting		57
			1875 lbs.
(2)	GSFC Support Equipment:		
	Command and Data Handling		228 lbs:
	Harness	approx.	170
	Thermal Systems	approx.	465
	Instrument Support Structures (1-760, 2-460, 3-125, 4-50, 5-41, 6-59)	approx.	1495
	Misc. Support Structures	approx.	85
		approx.	2443 lbs.
(3)	Instruments:		
	Plasma Diagnostics Package and REM		598 lbs.
	Vehicle Charging and Potential		276
	Shuttle-Spacelab Induced Atmosphere		181
	Solar Flare X-Ray Polarimeter		460
	Solar UV Irradiance Monitor		155
	Thermal Canister Experiment		802
	Contamination Monitor		17
			2489 lbs.
(4)	Total Integrated Pallet Weight	approx.	6807 lbs.
(5)	Payload Chargeable Items:		
	Fwd. Utility Kit		391 lbs.
	Timing Buffer and Instrument		3
	STD Switch Panel and Hardware		20
	Utility Kit Fluid		15
	Bridge and Keel Fittings		832
			1261 lbs.
(6)	Orbiter Cabin Equipment:		
	AFD Panel		40 lbs.
	Tape Recorders		132
	TR Panel		23
	Cables (CSD Recorder)		5
	Plant Growth Unit		55
			255 lbs.
(7)	Total Mission Weight	approx.	8323 lbs.
(8)	Allocated Mission Weight		8200 lbs.
(9)	Mission Contingency		

TABLE A-3

Test Run Summary

Date	Run No.	Nominal Setup Level	Duration	Overall Level Attained
9/11/80	1	130 dB	5 seconds	126 dB
9/12/80	2	133 dB	10 seconds	130 dB
9/16/80	3	136 dB except 31.5 Hz band reduced 3 dB	15 seconds	133 dB
9/18/80	4	139 dB except 31.5 Hz & 50 Hz bands reduced 3 dB	15 seconds	135 dB
9/23/80	5	142 dB empty chamber except 31.5 Hz & 50 Hz bands reduced 3 dB	15 seconds	136 1/2 dB
9/25/80	6a	145 dB empty chamber except for certain bands*	5 seconds	141 dB
9/25/80	6b	145 dB empty chamber except for certain bands*	15 seconds	141 1/2 dB

* For runs 6a and 6b the following bands were changed:

a) reduced 3 dB--31.5 Hz, 50 Hz
b) increased 3 dB--160 Hz, 200 Hz, 250 Hz, 315 Hz, 400 Hz, 500 Hz, 630 Hz, 800 Hz
c) reduced 4 dB--1000 Hz

TABLE A-4

Nominal Test Levels
1/3- OB Sound Pressure Level Re 20 $\mu N/m^2$

1/3 OCTAVE BAND CENTER FREQUENCY (Hz)	TEST # 1	TEST #2	TEST # 3	TEST # 4
31.5	107	110	113	116
40	109	112	115	118
50	111	114	117	120
63	112.5	115.5	118.5	121.5
80	114.5	117.5	120.5	123.5
100	115.5	118.5	121.5	124.5
125	117	120	123	126
160	118	121	124	127
200	118.5	121.5	124.5	127.5
250	119	122	125	128
320	119.5	122.5	125.5	128.5
400	119.5	122.5	125.5	128.5
500	119	122	125	128
630	118.5	121.5	124.5	127.5
800	118	121	124	127
1000	117	120	123	126
1250	116.5	119.5	122.5	125.5
1600	115	118	121	124
2000	114	117	120	123
2500	113	116	119	122
3200	11.5	114.5	117.5	120.5
4000	110	113	116	119
5000	109	112	115	118
6300	107.5	110.5	113.5	116.5
8000	106	109	112	115
10000	105	108	111	114
Overall Level	130	133	136	139

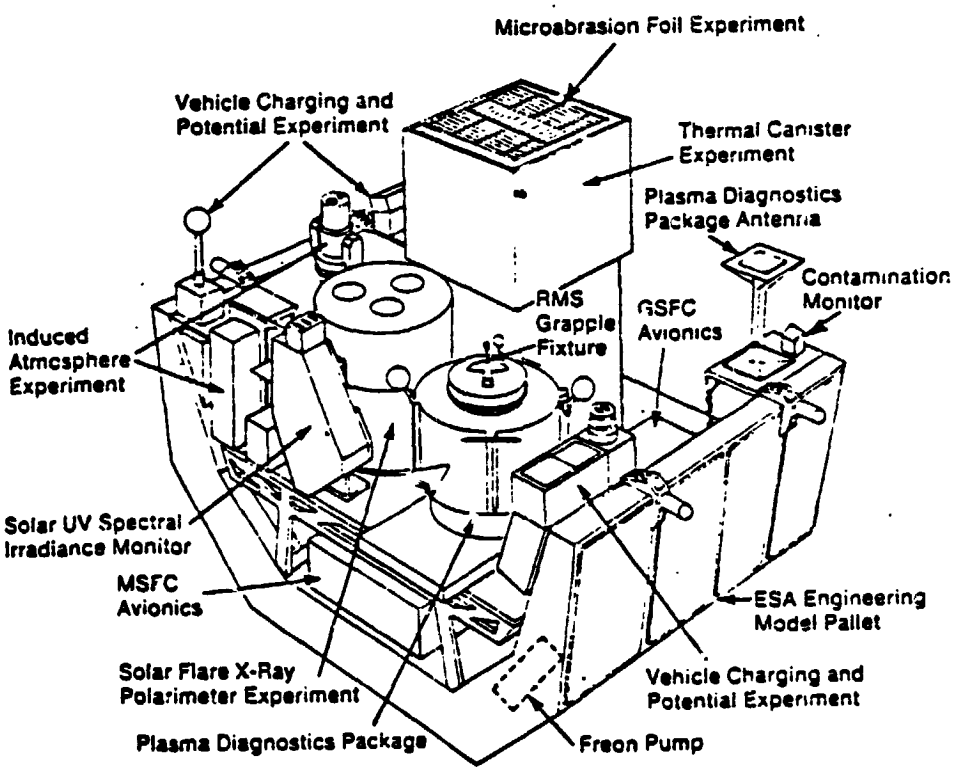


Figure A-1 OSS-1 Pallet Payload Configuration without Thermal Blankets

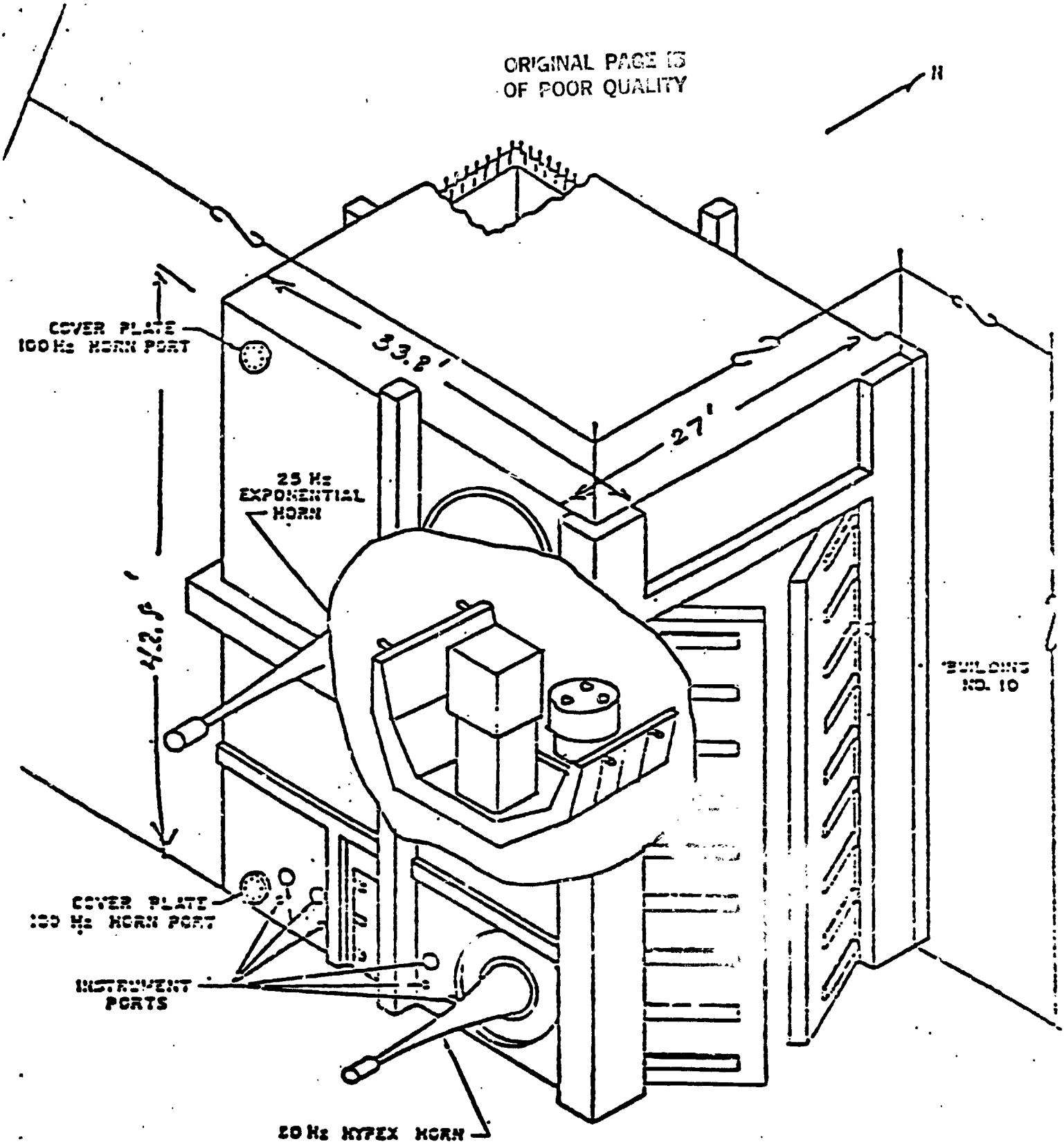


Figure A-. . allet / Chamber Orientation

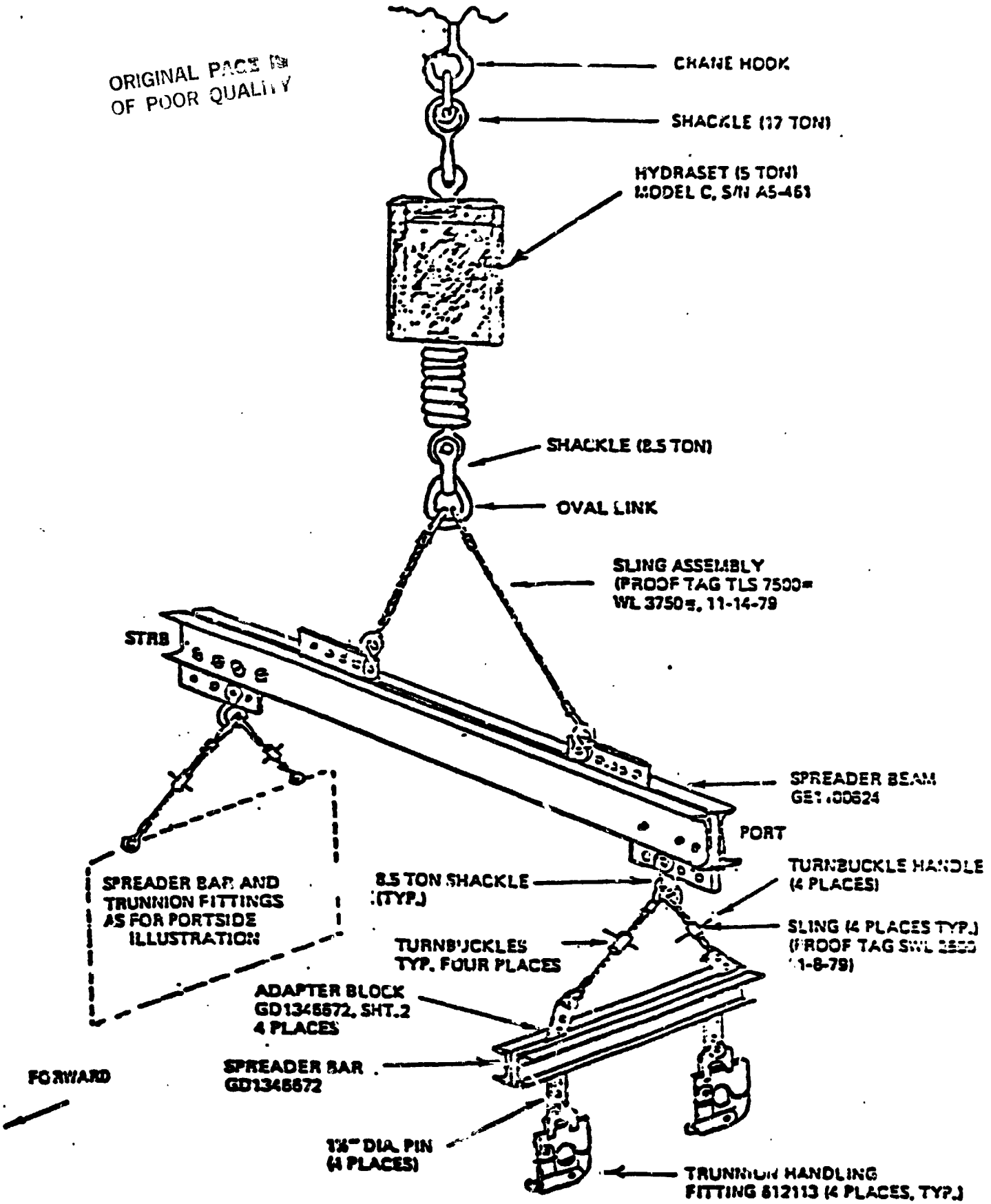


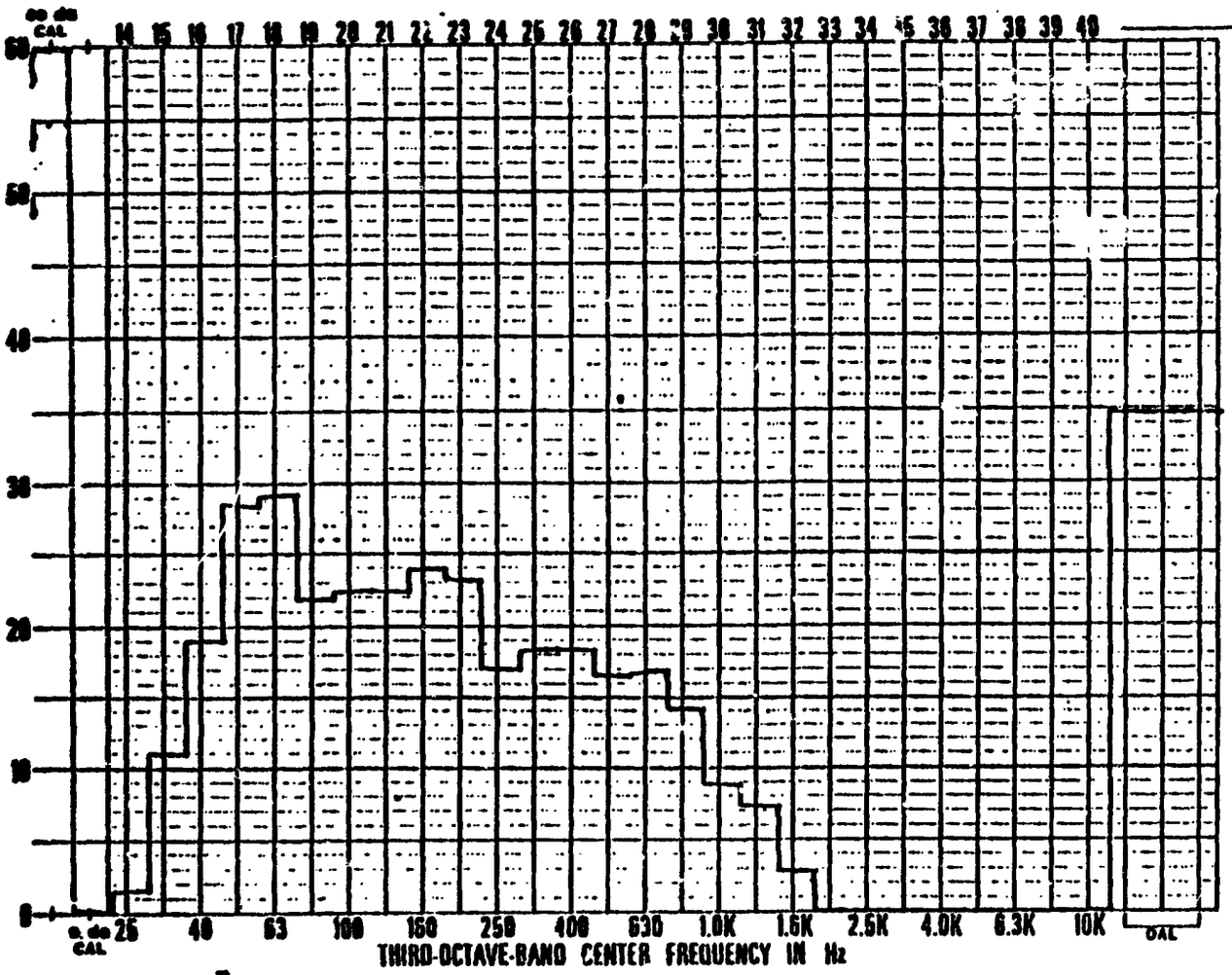
Figure A-3 Lifting Sling

APPENDIX B

OSS-1 Payload Acoustic Test Data

CHART 1522-9989 FOR USE WITH 1522 DC RECORDER & 1521 REAL-TIME ANALYZER GENERAL RADIO CO. CONCORD, MASS. U.S.A.

Full Scale= 157 dB



PROJECT DSS-1 FLIGHT PALLET
ACOUSTIC TEST
DATE 9-25-80
XDCR IDENT MIC # 1
INSIDE T. C.
FULL SCALE = 157 dB
INTEGRATION TIME 4 SEC
TEST RUN 6.6 146dB EMPTY
REMARKS: CHAMBER SET UP
PLUS AMENDMENT #5
155CL TEST
OFF TAPE

Figure B-1 1/3-OB Sound Pressure Level
DATE Microphone M1

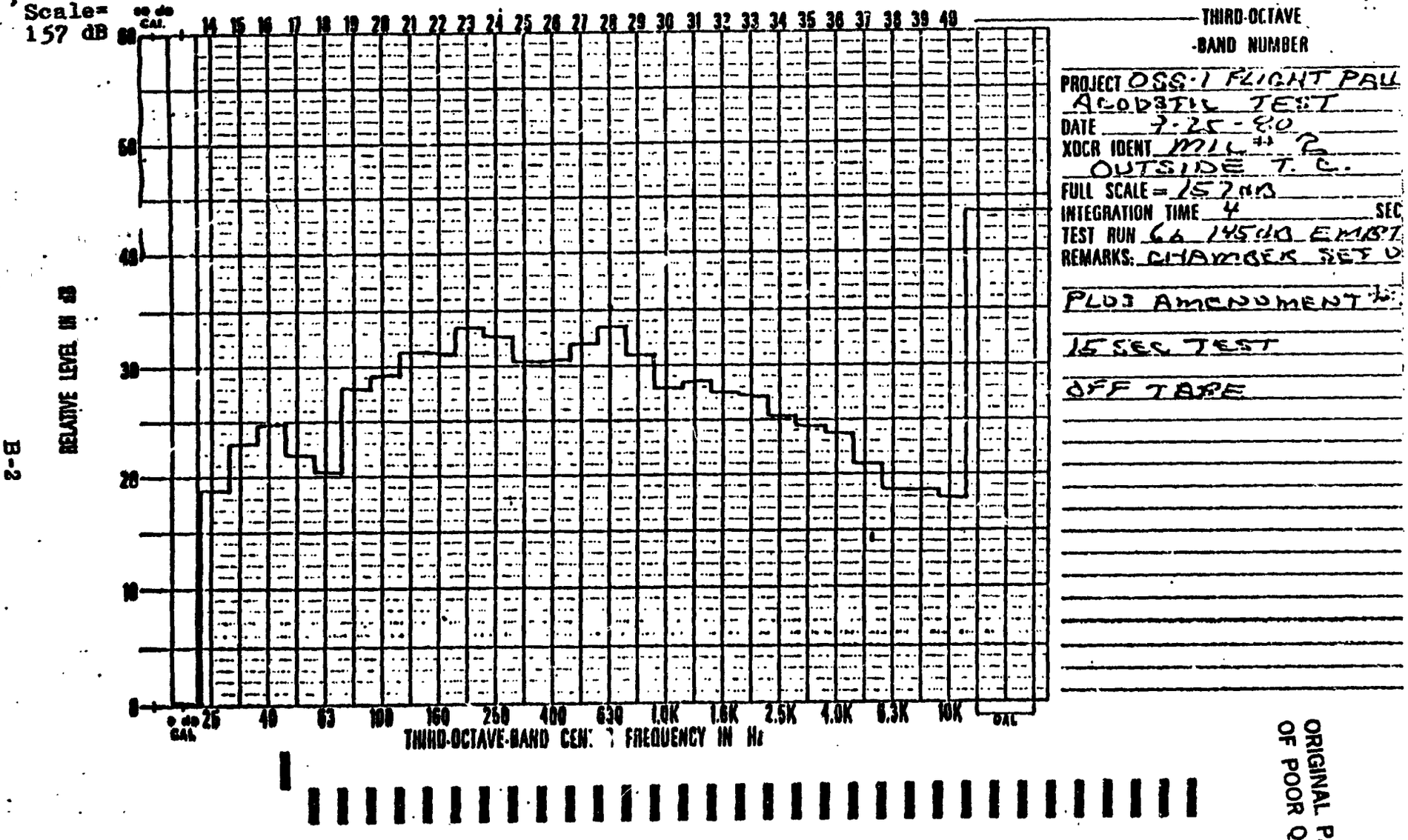
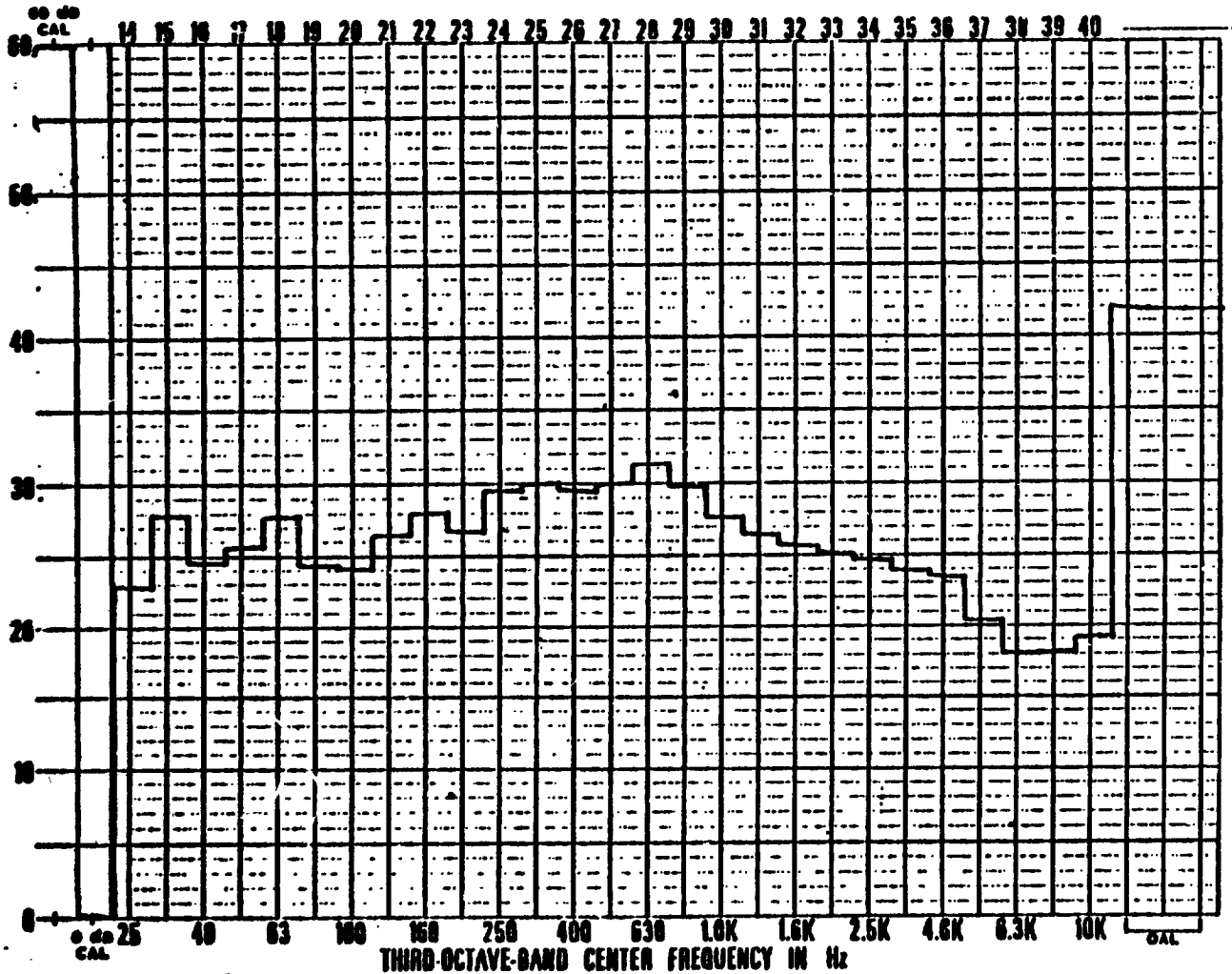


Figure B-2 1/3-OB Sound Pressure Level
DATE Microphone M2

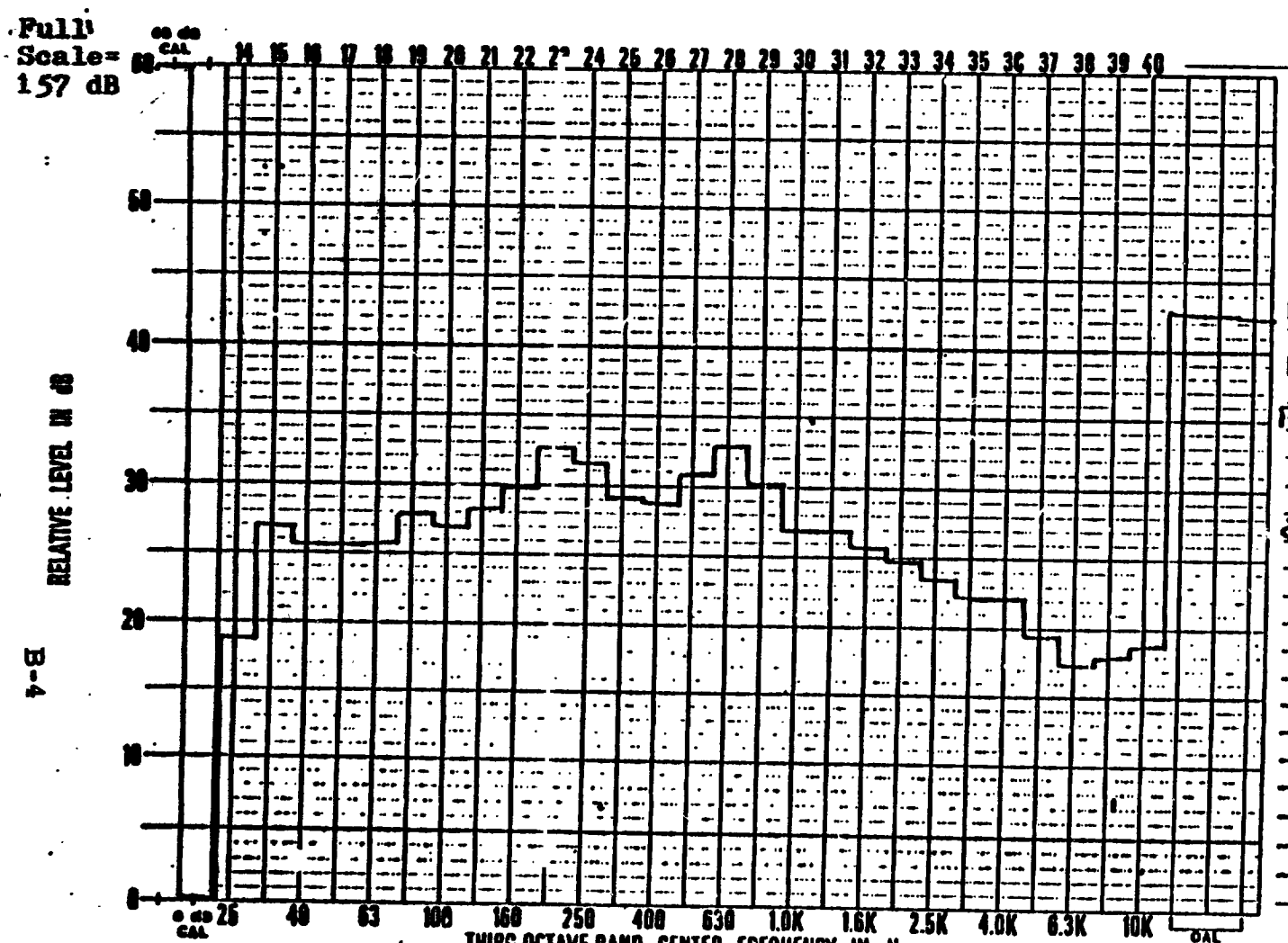
Full Scale= 157 dB



PROJECT 033 FLIGHT FAIRET ACOUSTIC TEST
DATE 9-25-80
XDCR IDENT MIC # 3 SILL SHELF 6
FULL SCALE = 157 dB
INTEGRATION TIME 4 SEC
TEST RUN 60 145 dB EMPTY
REMARKS: CHAMBER SET UP PLUS AMENDMENT #5 15 SEC TEST OFF TAPE

B-3

Figure B-3 1/3-OB Sound Pressure Level
DATE Microphone M3



B-4

Figure B-4 1/3-OB Sound Pressure Level
DATE Microphone M4

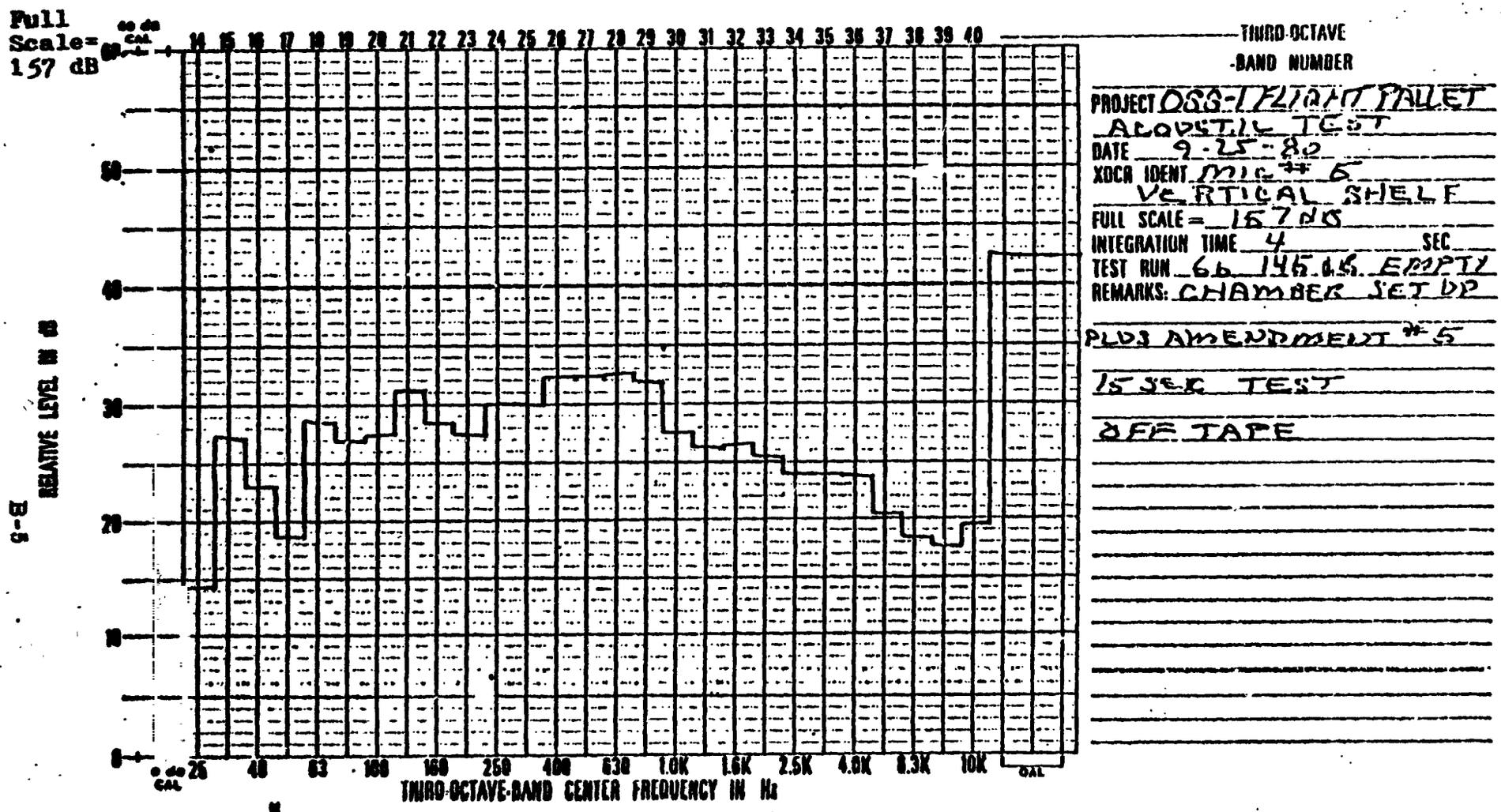


Figure B-5 1/3-OB Sound Pressure Level
DATE Microphone M5

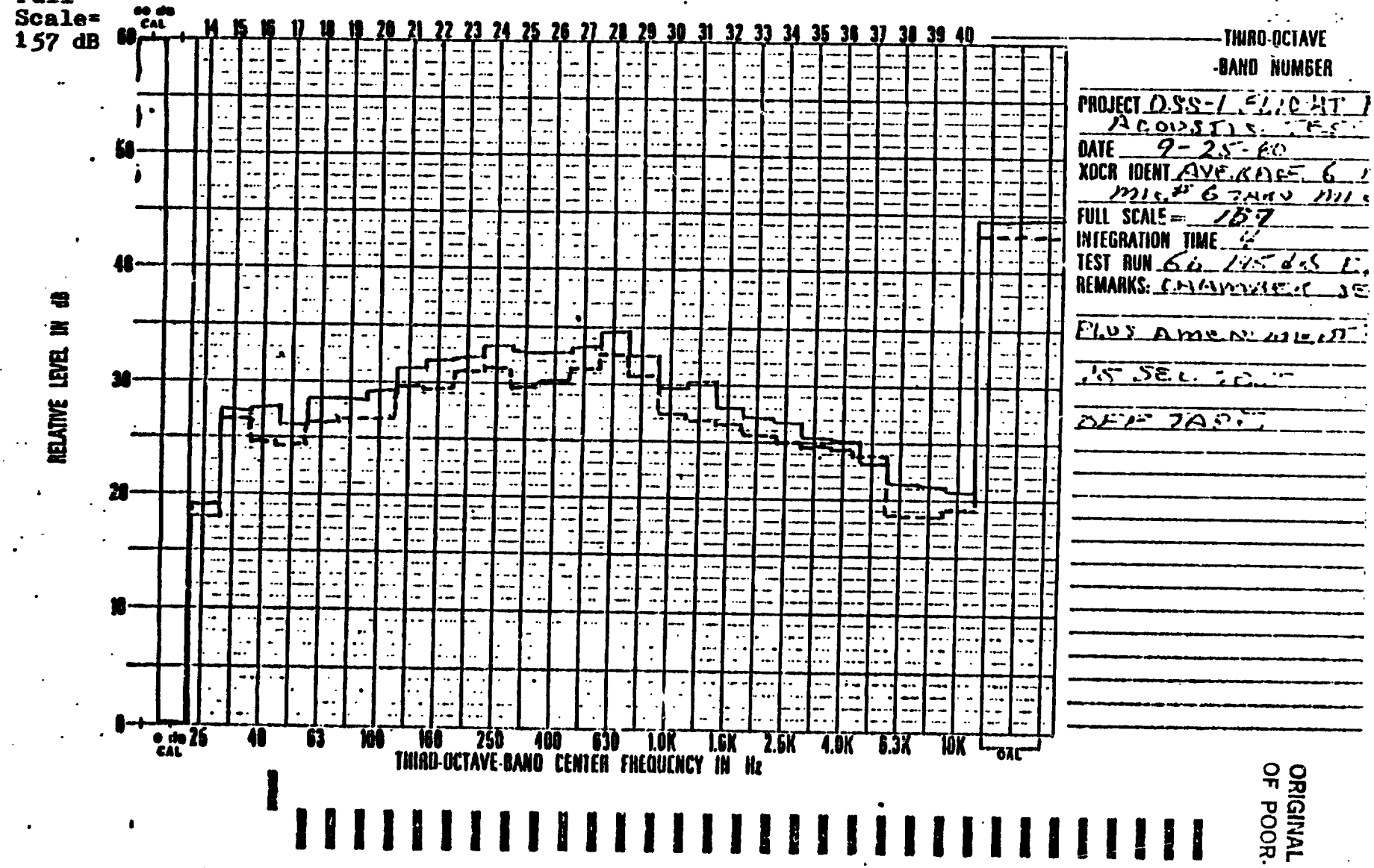


Figure B-6 Average 1/3-OB Sound Pressure Level
——— Based on Six Test Control Microphones (M6 - M11)
---- Based on four Date Microphones (M2-M5)

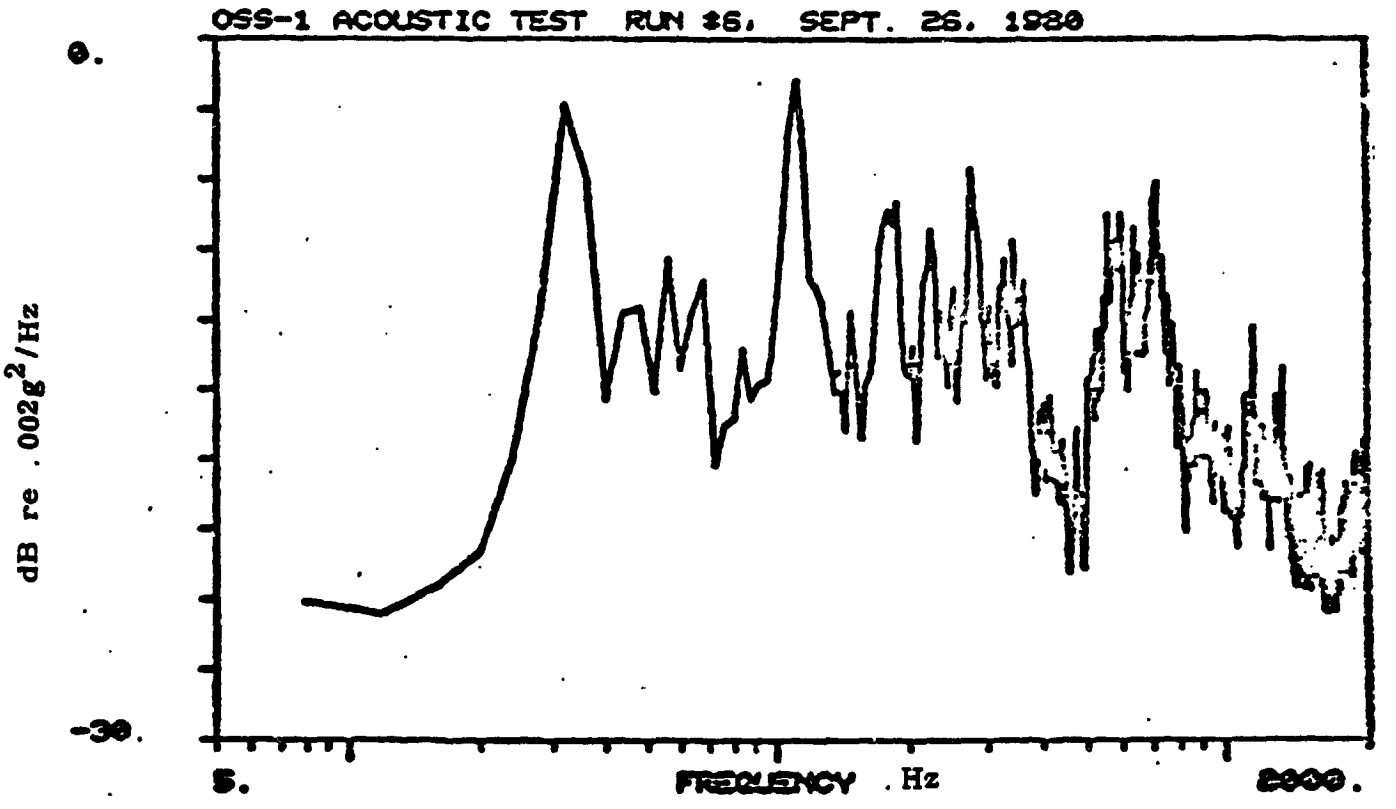


Figure B-7 Power Spectral Density
Type: HFA
Loc: Aft Side Vertical Platform
Dir: x

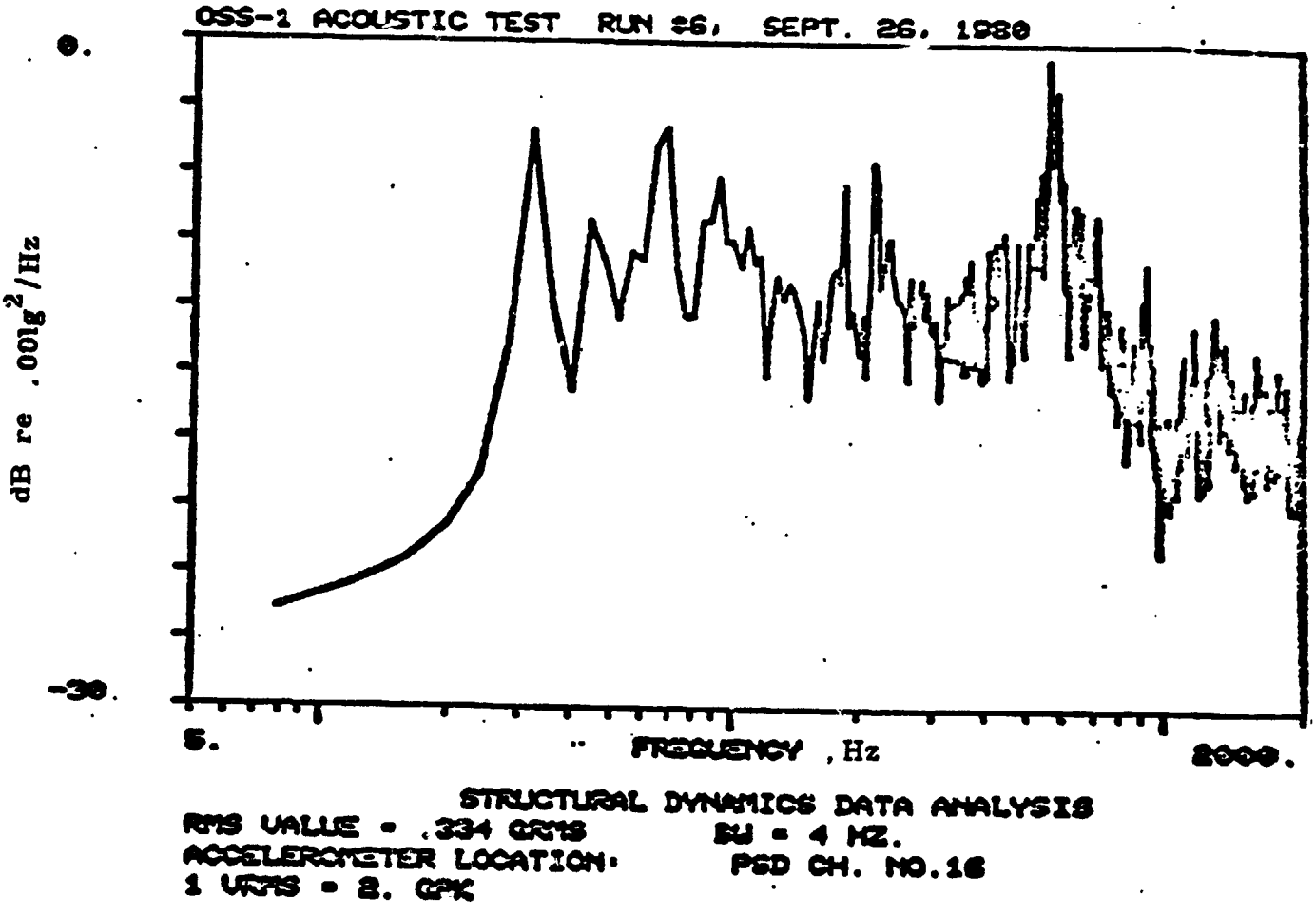


Figure B-8 Power Spectral Density
Type: HFA
Loc: Aft Side Vertical Platform
Dir: z

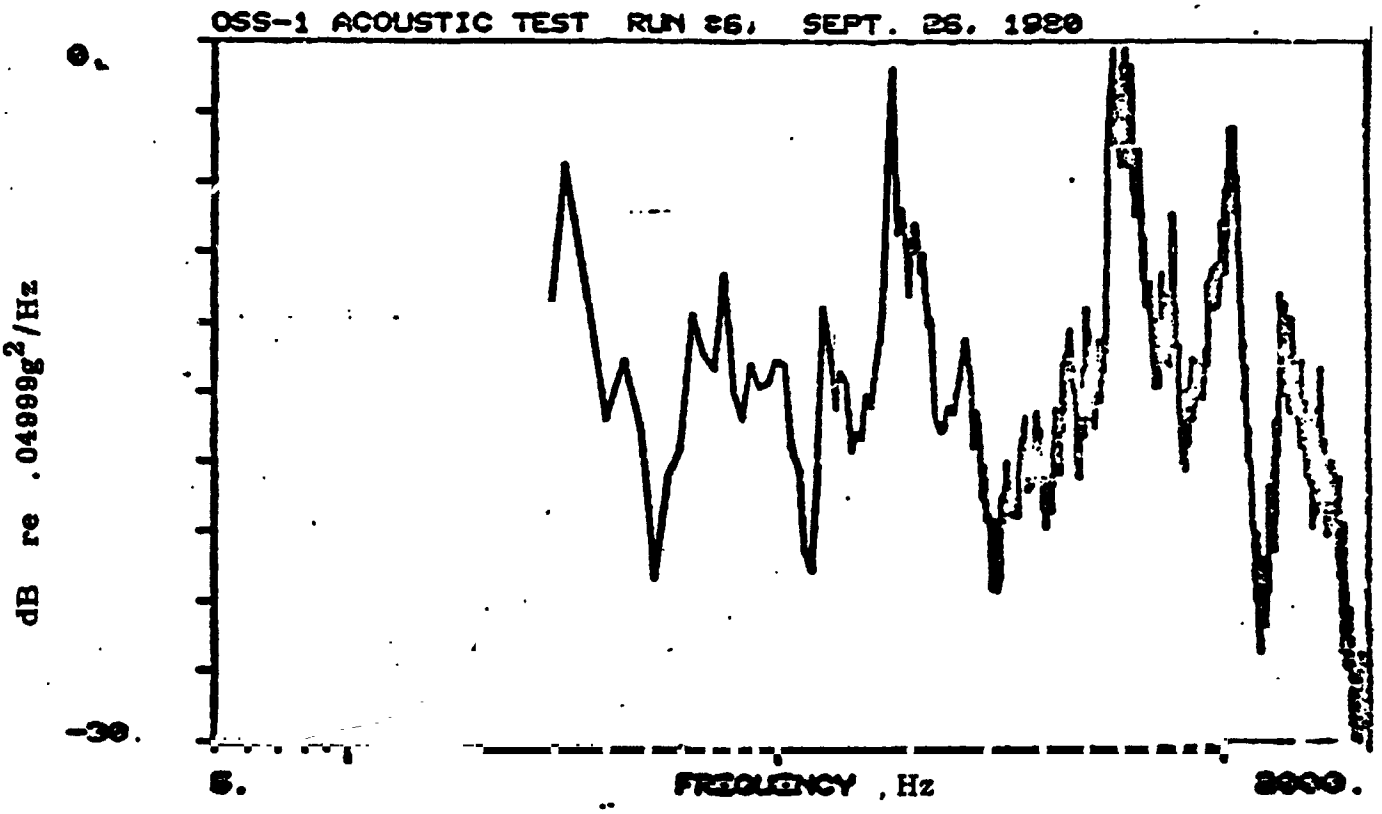


Figure B-9 Power Spectral Density
Type: HFA
Loc: SRPA Instr. Support Bracket
Dir: x

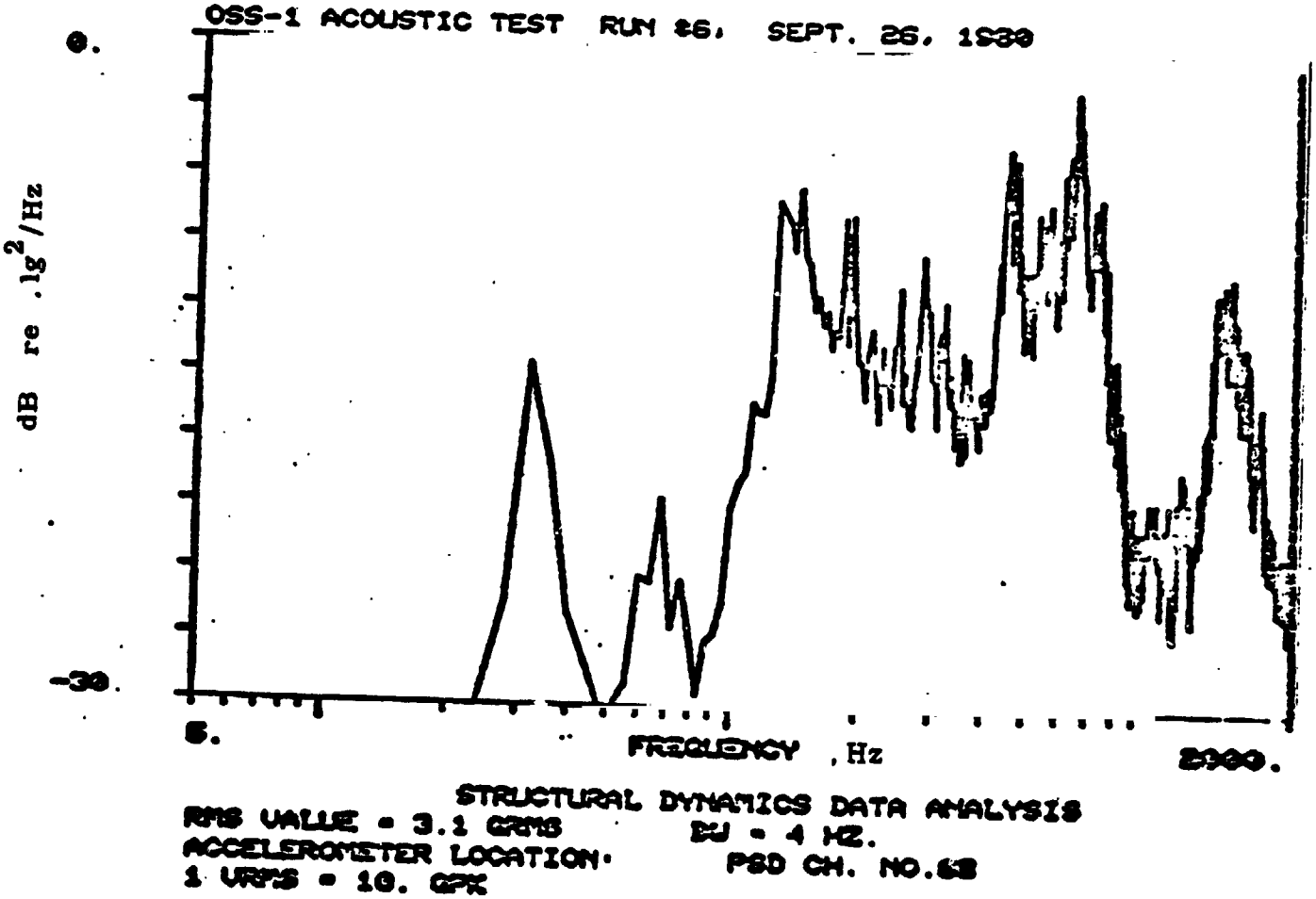


Figure B-10 Power Spectral Density
Type: HFA
Loc: SRPA Instr. Support Bracket
Dir: z

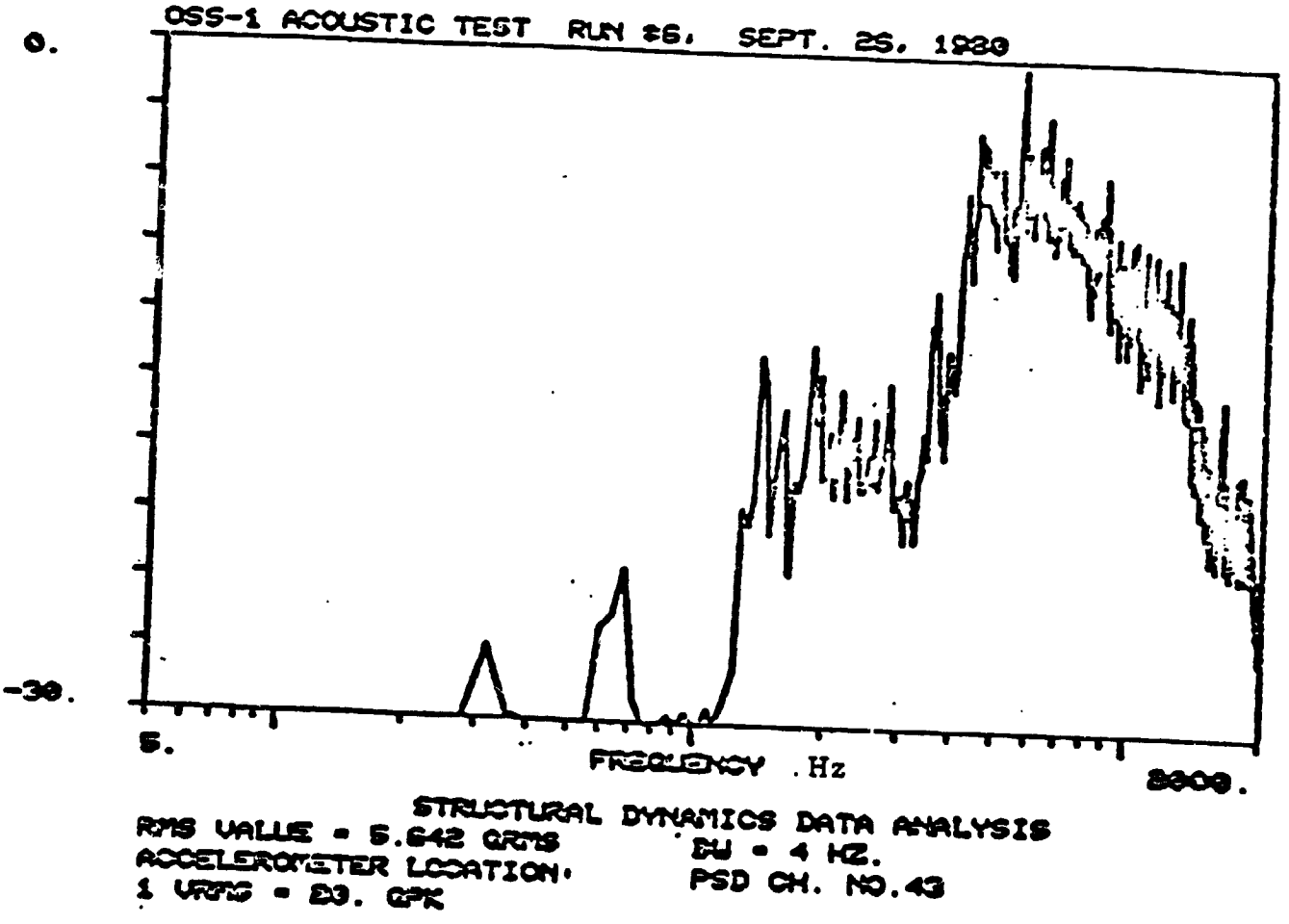


Figure B-11 Power Spectral Density
Type: HFA
Loc: Panel No. 4 Central Insert
Dir: x

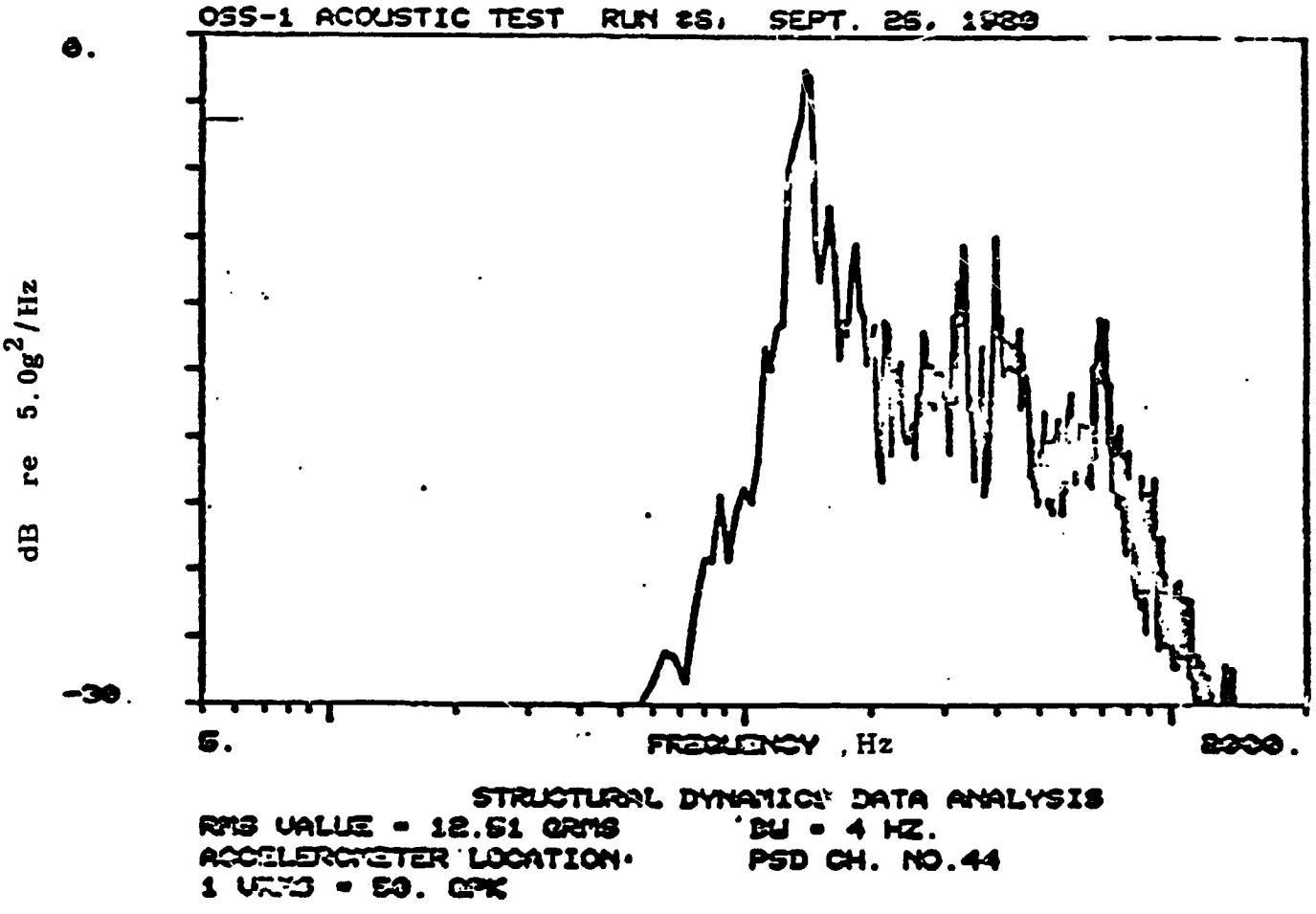


Figure B-12 Power Spectral Density
Type: HFA
Loc: Panel No. 4 Central Inse.t
Dir: Normal

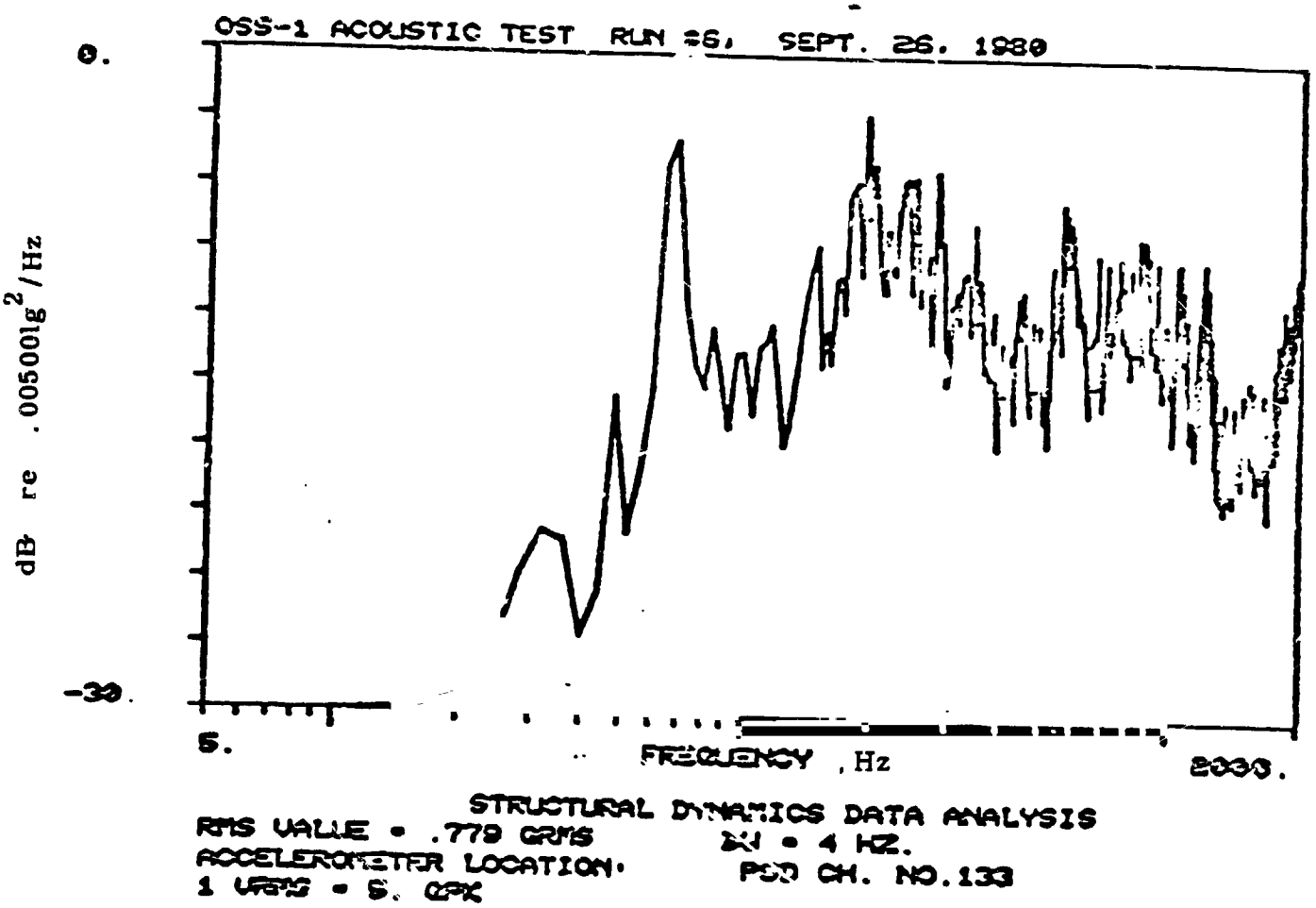


Figure B-13 Power Spectral Density
Type: HFA
Loc: Aft Side Thermal Cannister Base
Dir: x

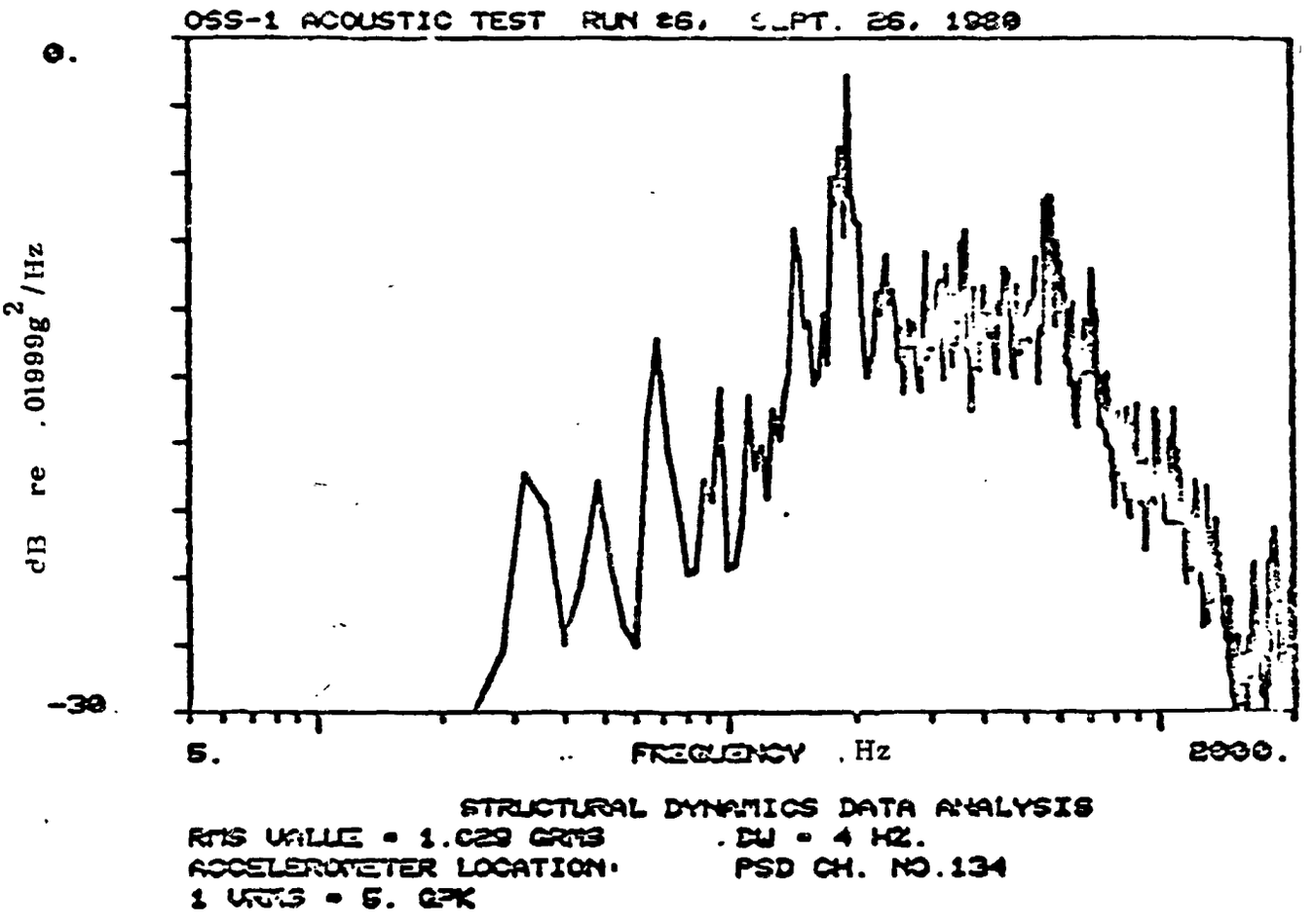


Figure B-14 Power Spectral Density
Type: HFA
Loc: Aft Side Thermal Cannister Base
Dir: z

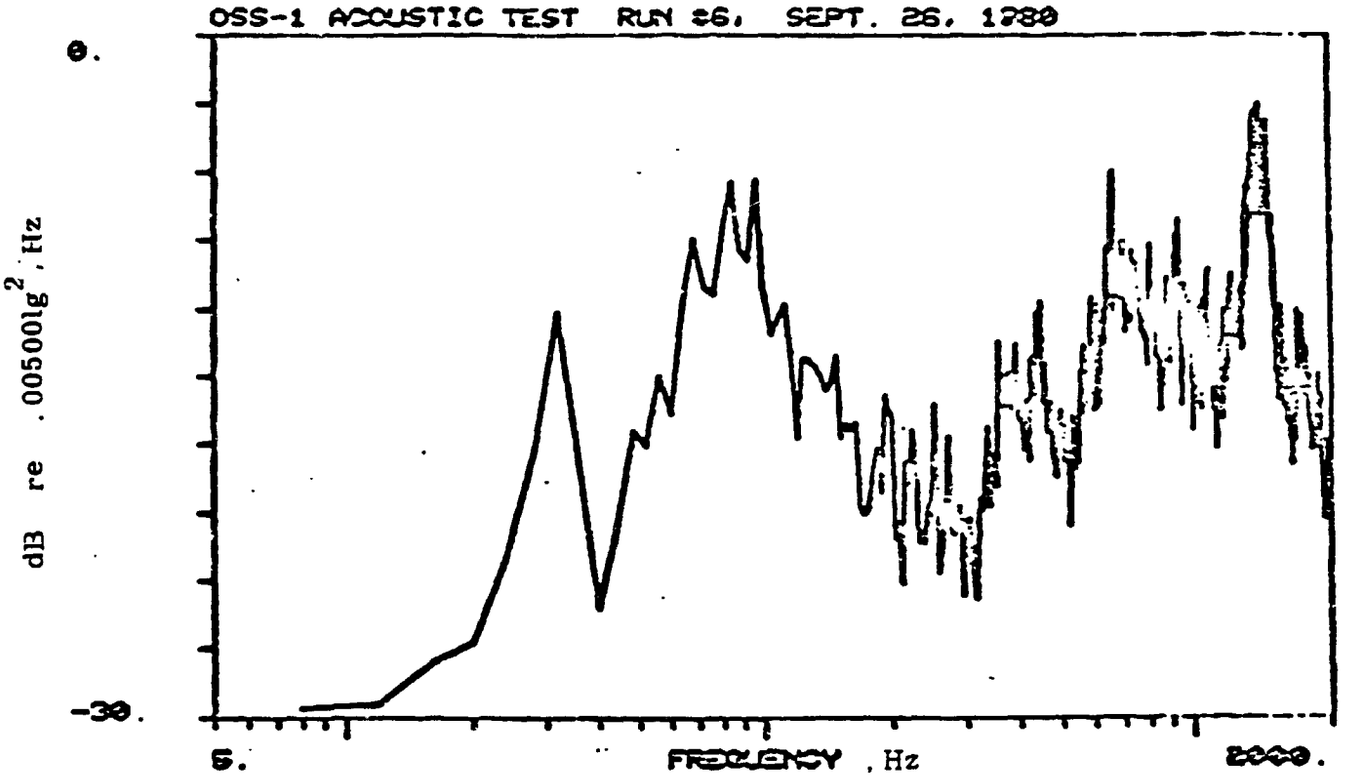


Figure B-15 Power Spectral Density
Type: HFA
Loc: Inside Therm. Cann. Fwd. Inbd. Corner
Dir: x

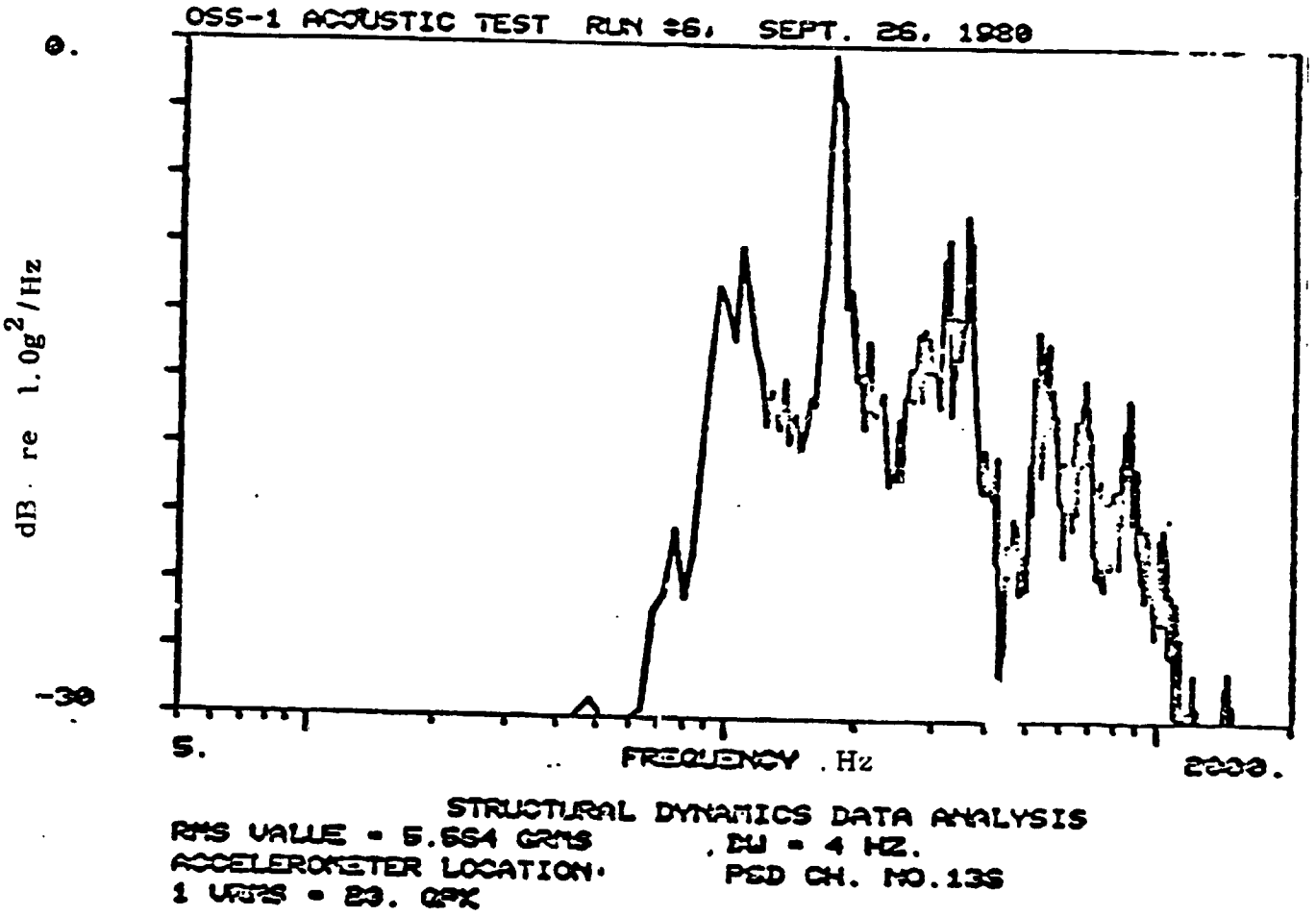


Figure B-16 Power Spectral Density
Type: HFA
Loc: Aft Inside Thermal Cannister
Dir: y

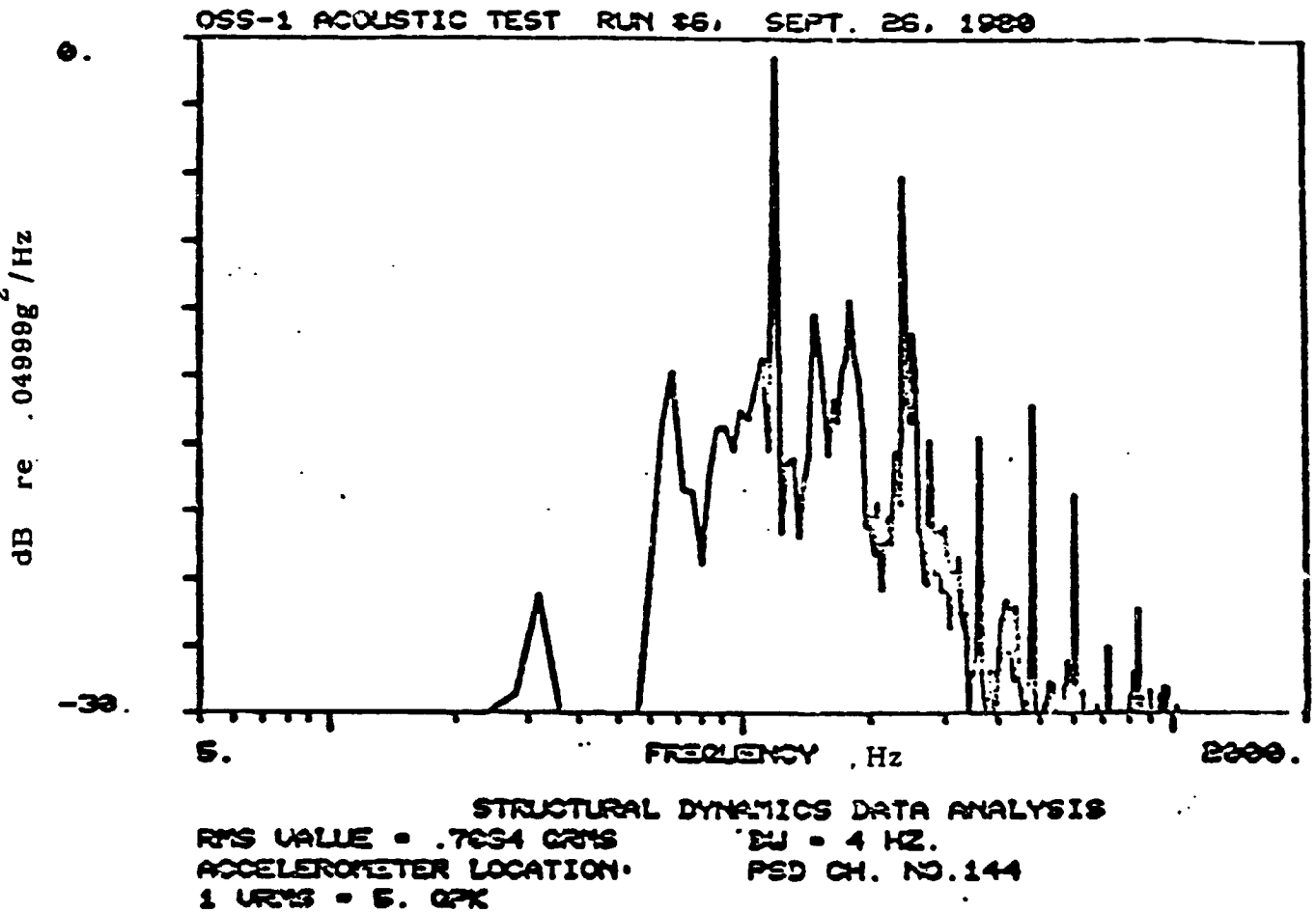


Figure B-17 Power Spectral Density

Type: HFA
Loc: Side of Cold Plate
Dir: In-plane x

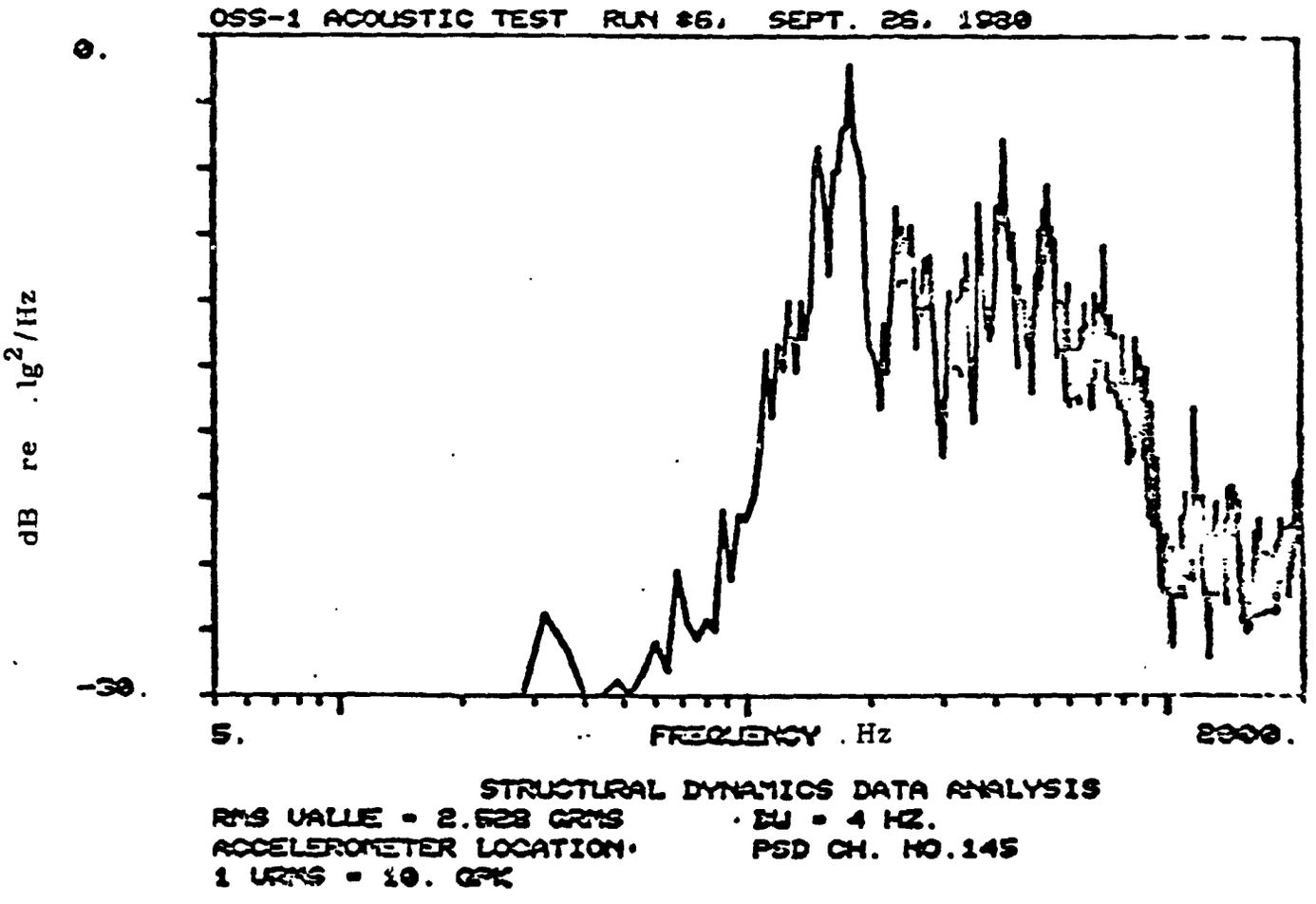


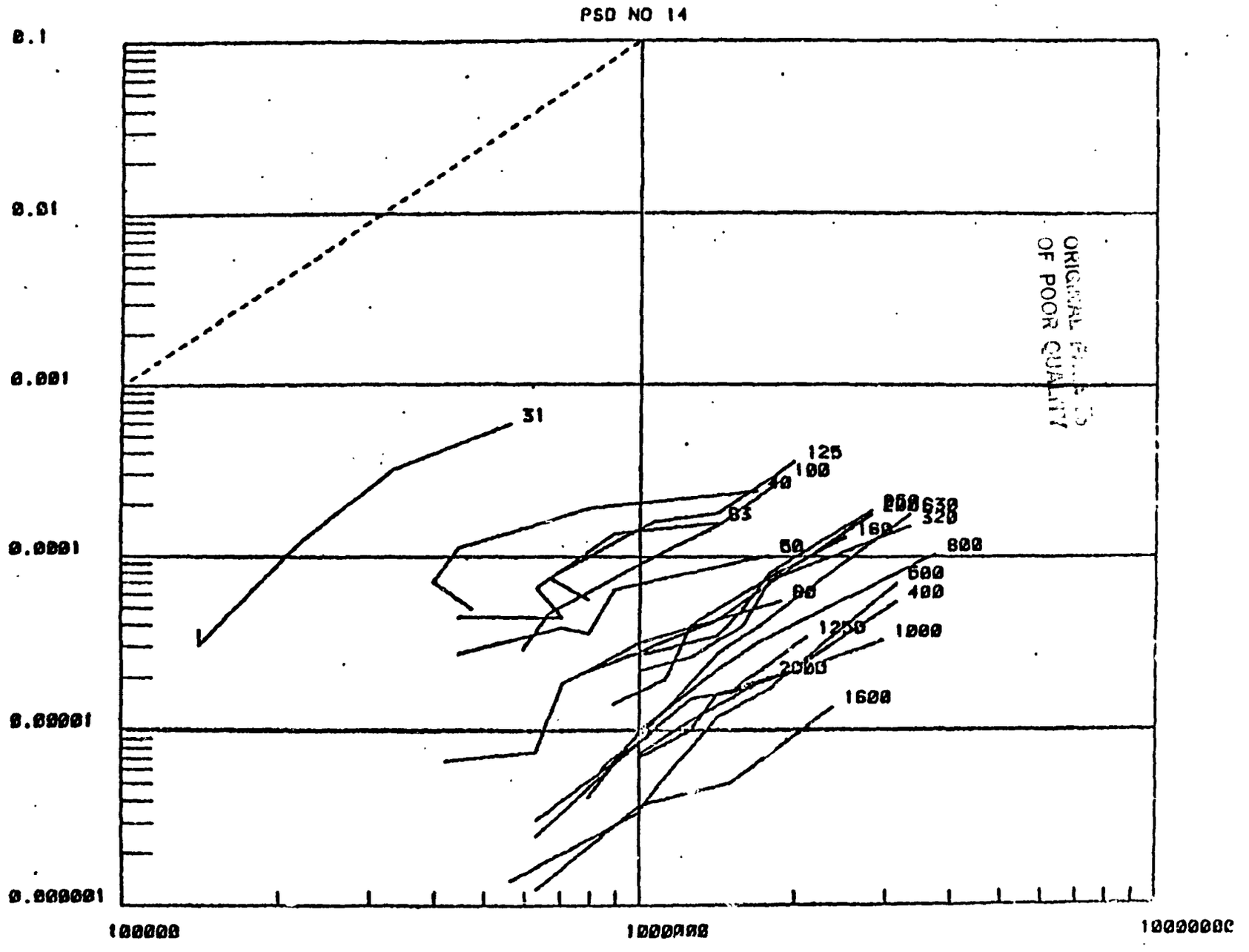
Figure B-18 Power Spectral Density
Type: HFA
Loc: Side of Cold Plate
Dir: Normal

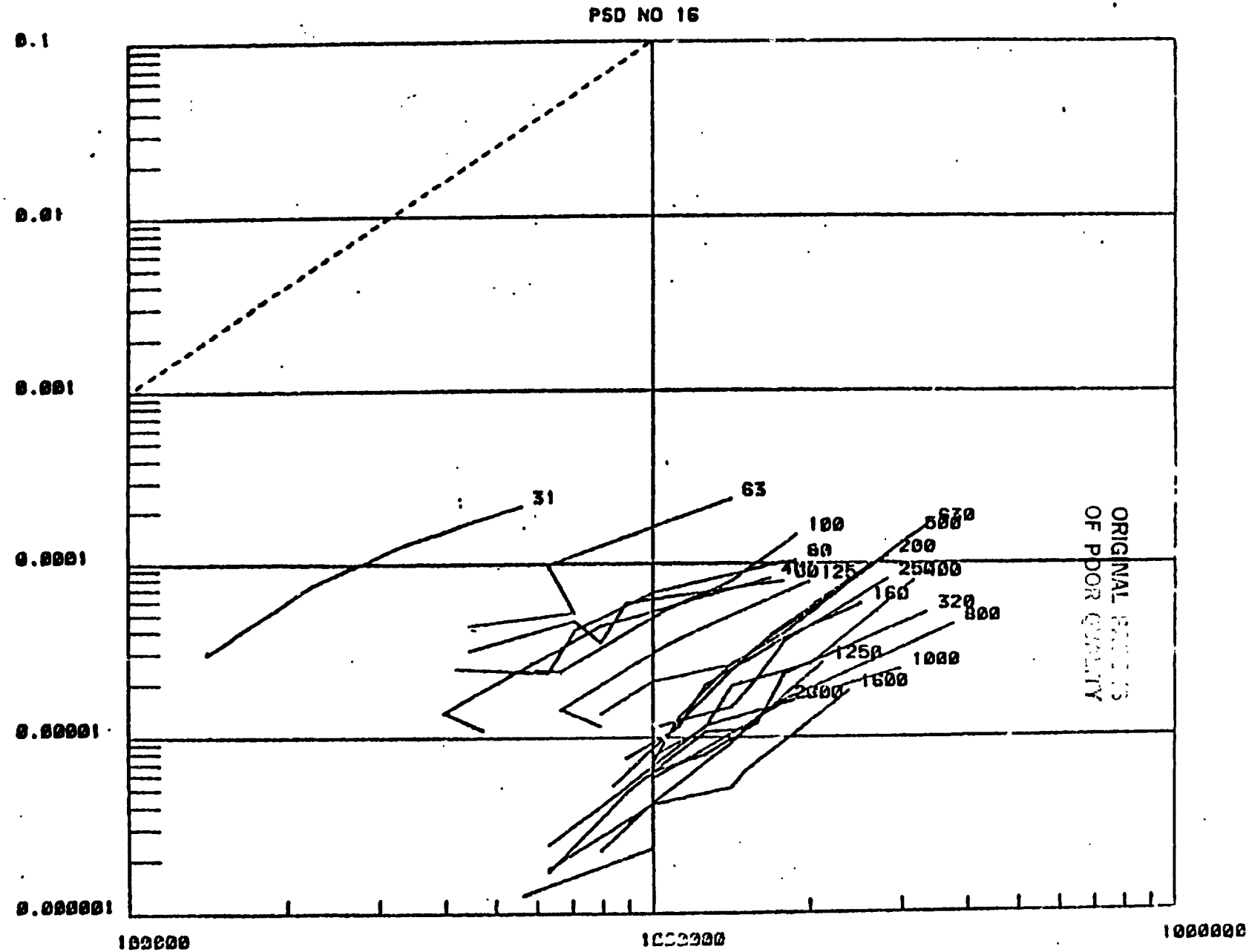
APPENDIX C

Vibration Data Linearity Over Test Levels

Vibration Data Linearity Over Test Levels

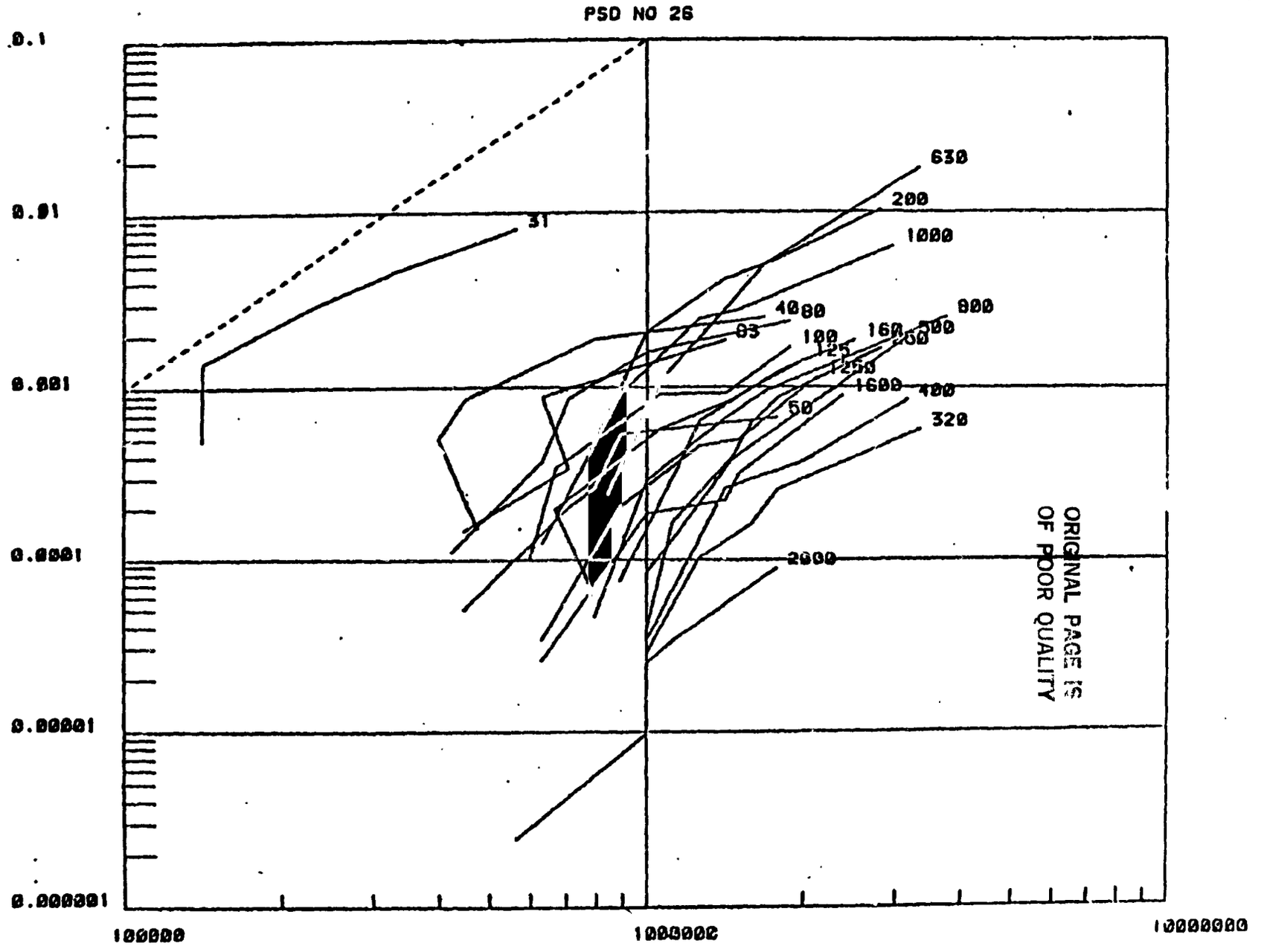
The figures in Appendix C present results showing the linearity of the measured vibration data over the five acoustic test levels. The results are plotted in terms of 1/3 octave bandwidth power spectral density (g^2/Hz) versus the six control microphone average 1/3 octave band sound pressure levels in dB. The abscissa indicated as a log scale is a linear dB scale based on dB = 20 log X. The linearity of the measured test data is compared to the theoretical linearity as shown by the dashed line with the constant slope. Based on the evaluation of these results, it is concluded that the linearity assumption required in the extrapolation of data to flight levels is approximately valid in the region of interest.





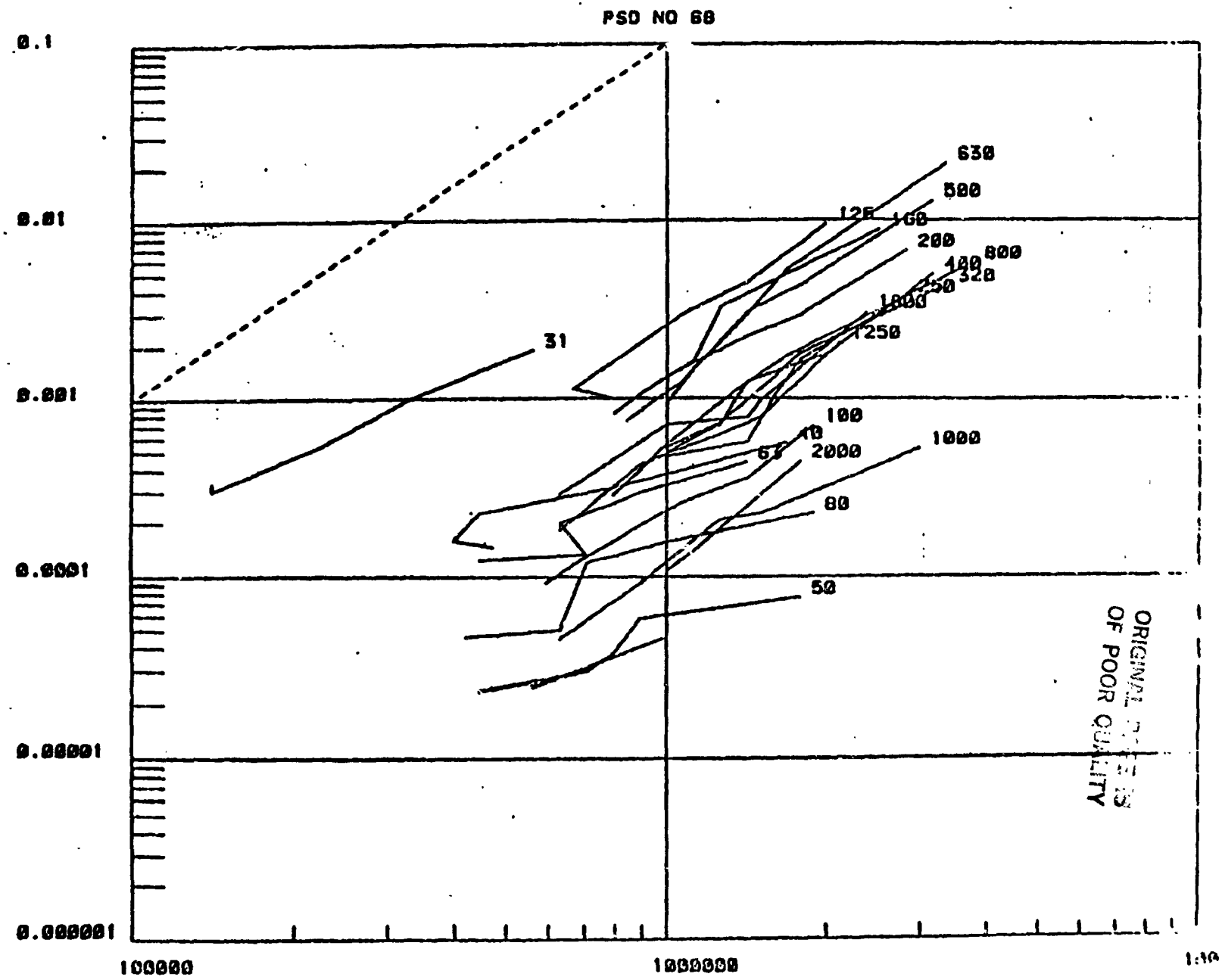
1/3-OB Power Spectral Density, g^2/Hz

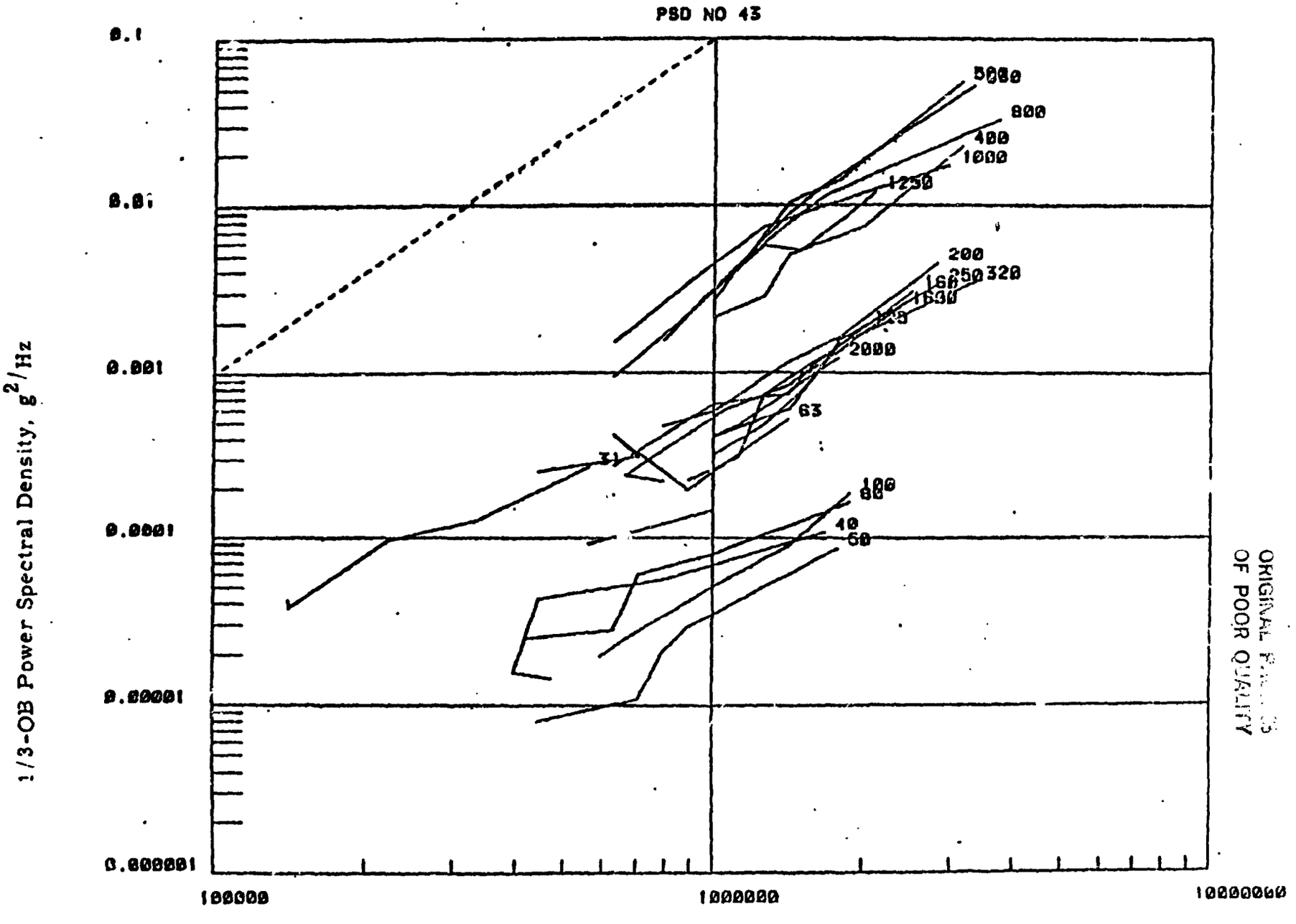
1/3-OBSPL = 20 Log X, dB

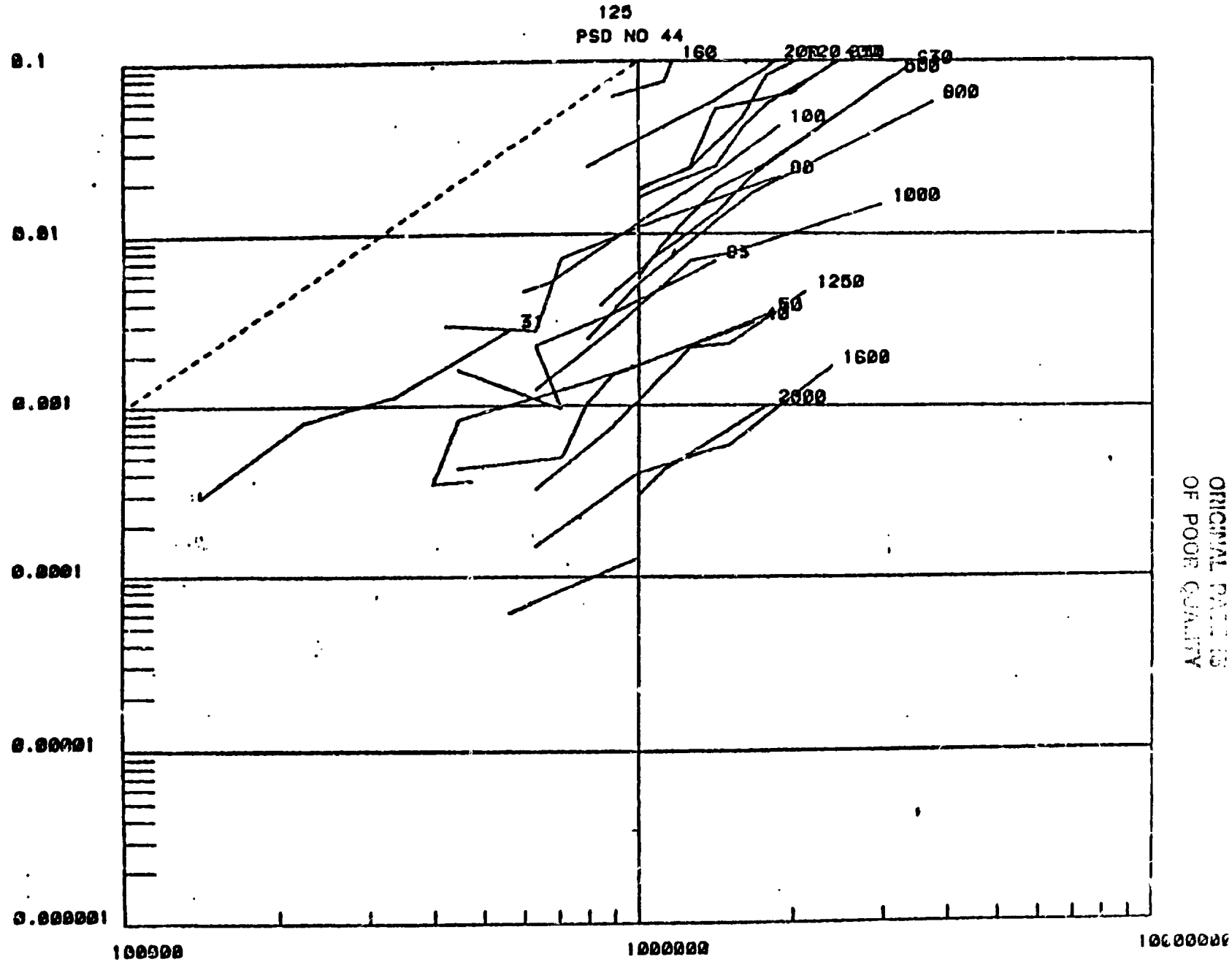


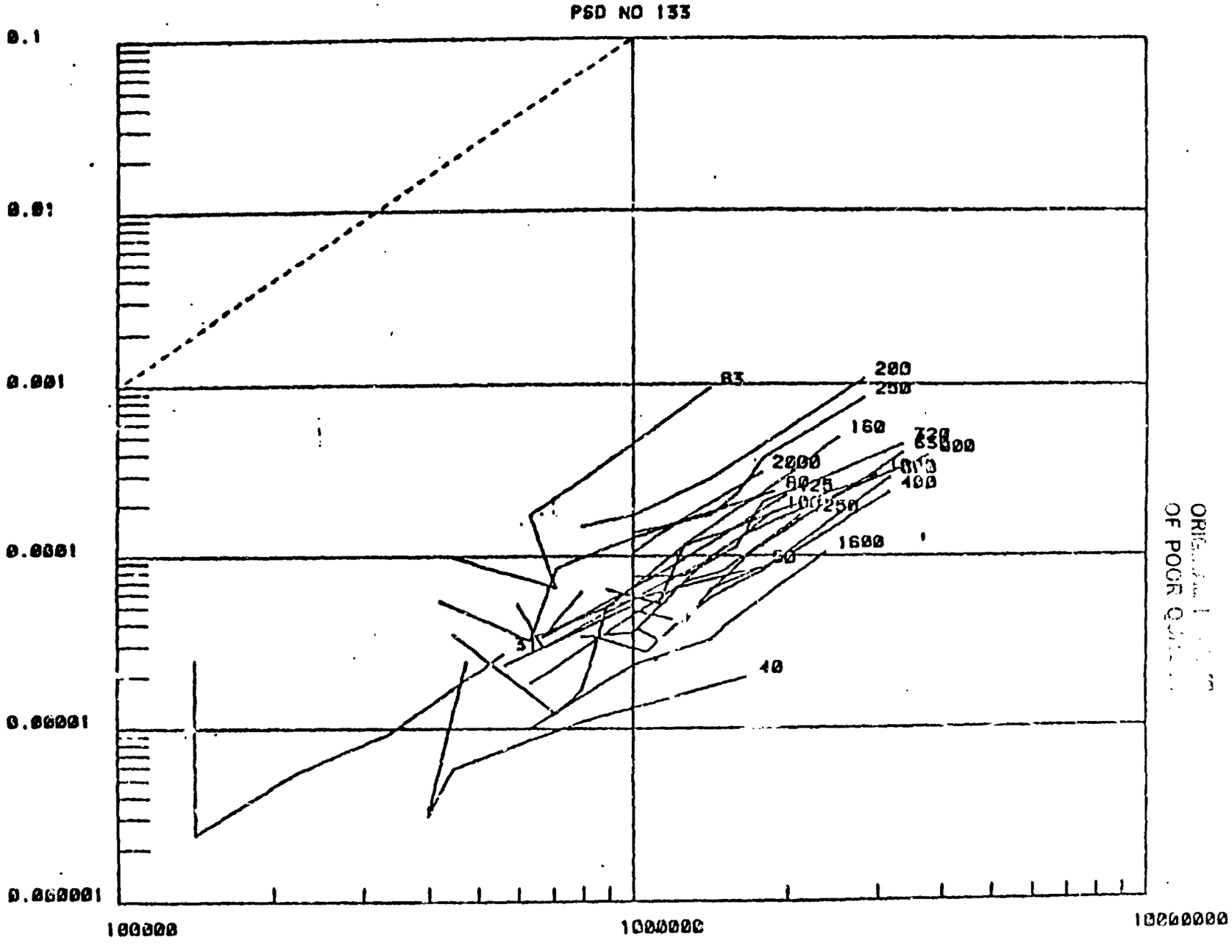
1/3-OB Power Spectral Density, g^2/Hz

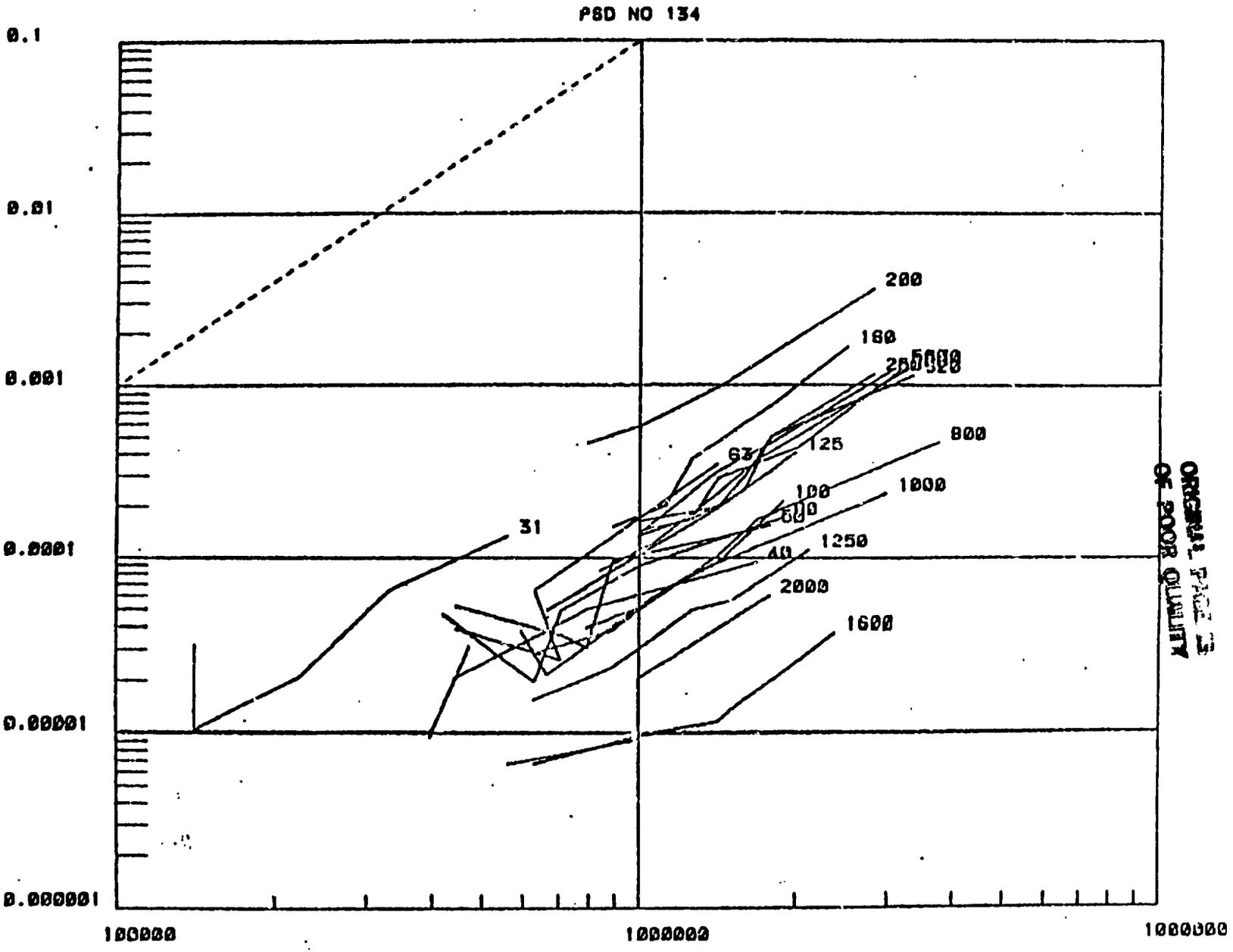
1/3-OBSPL = 20 Log X, dB

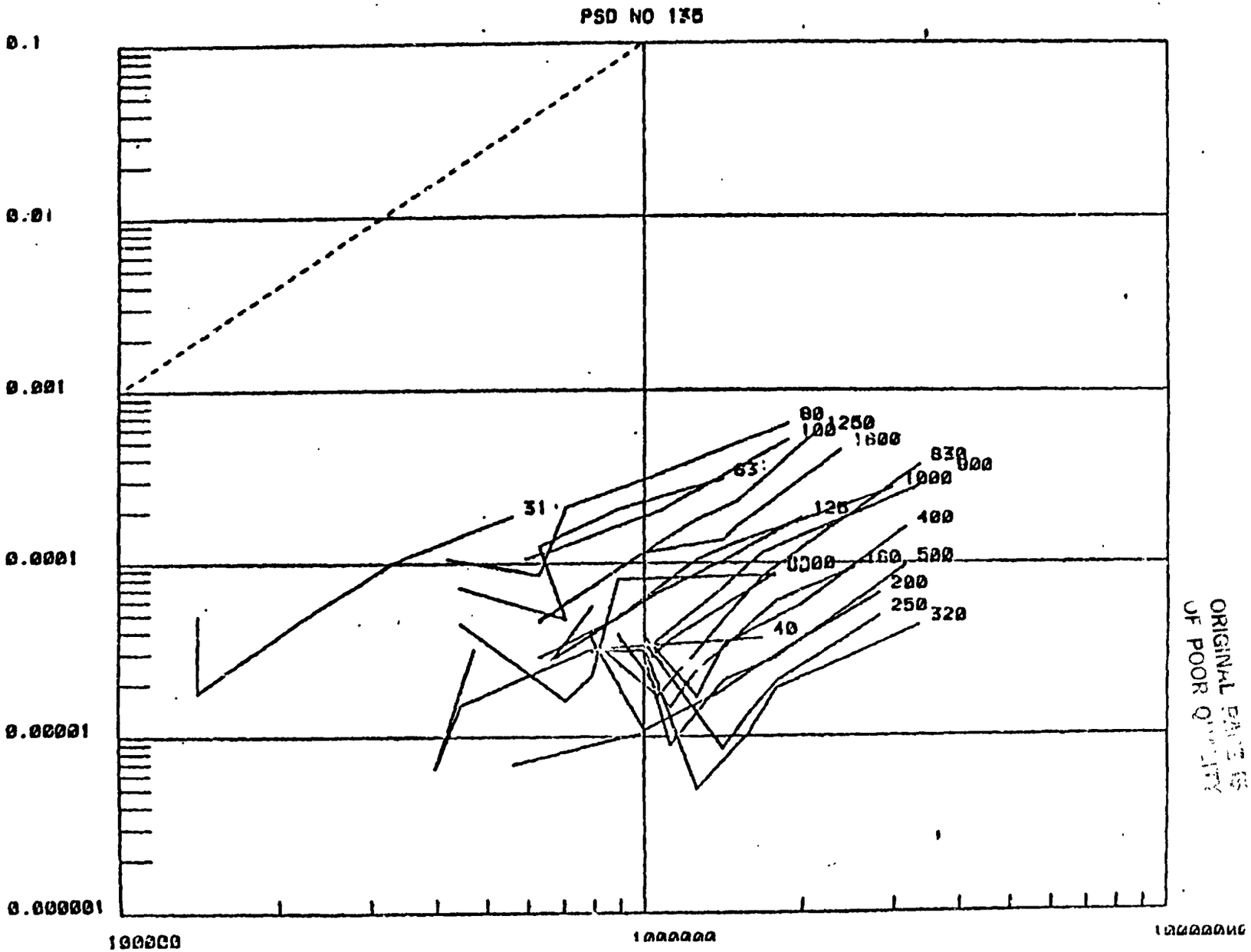


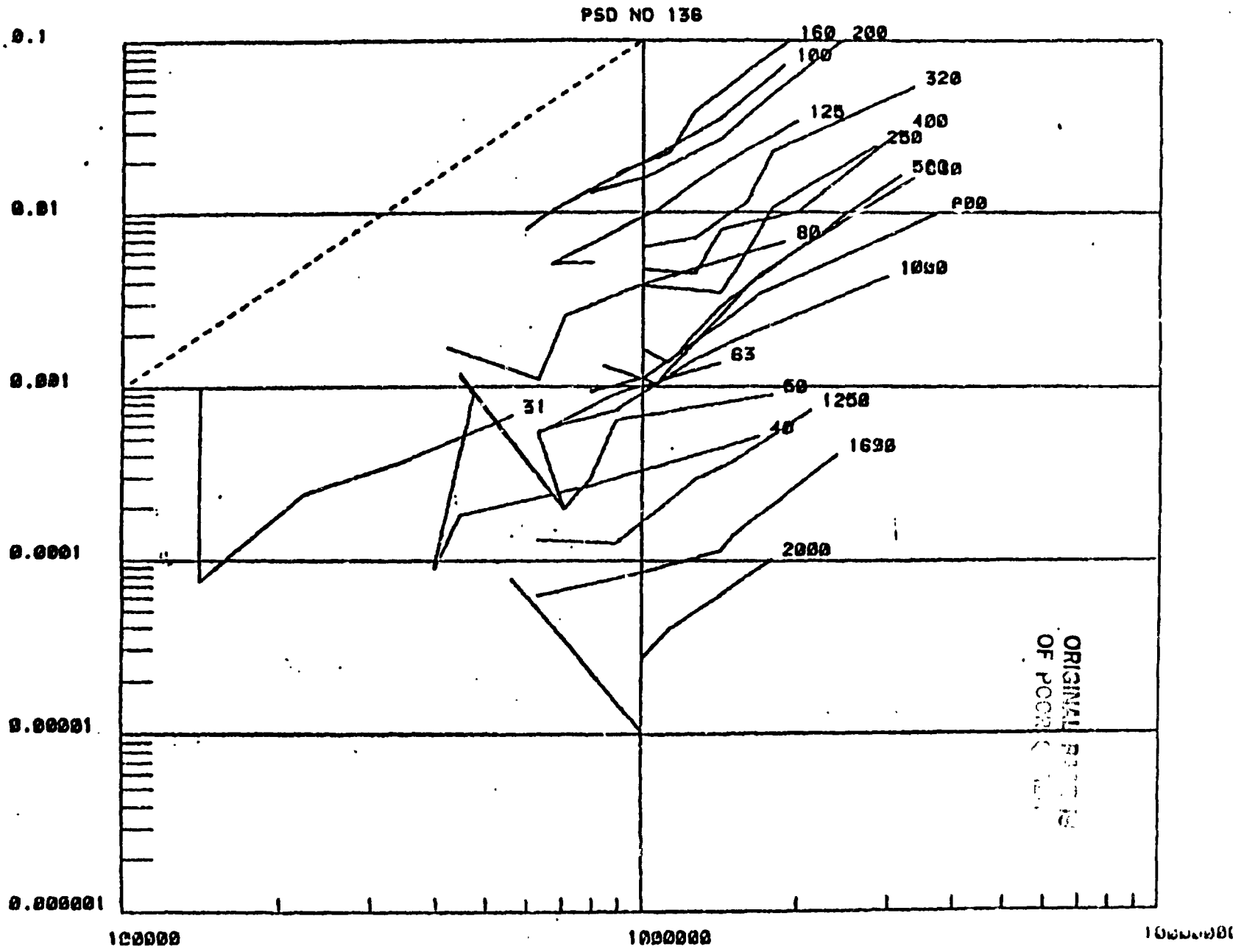






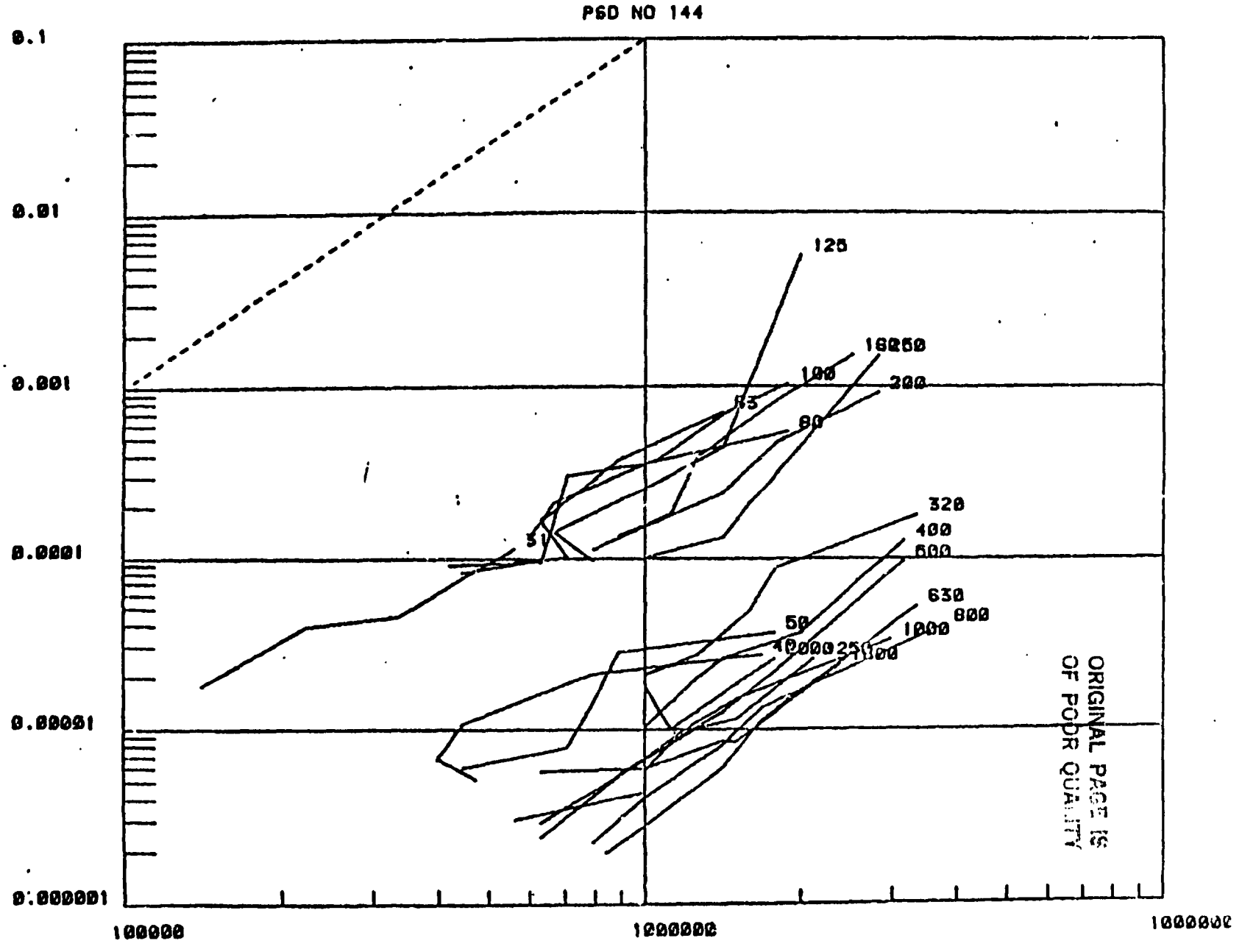


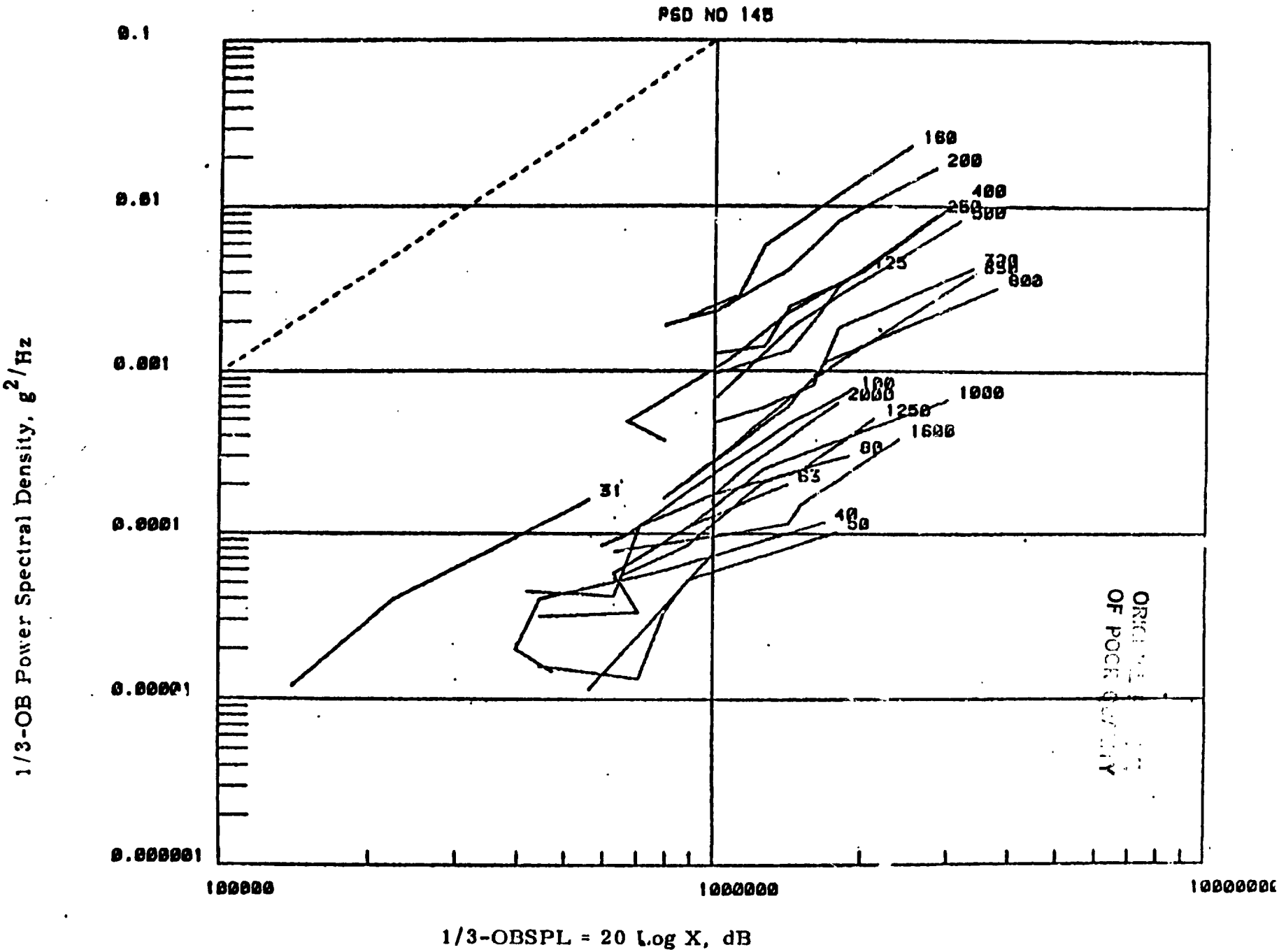


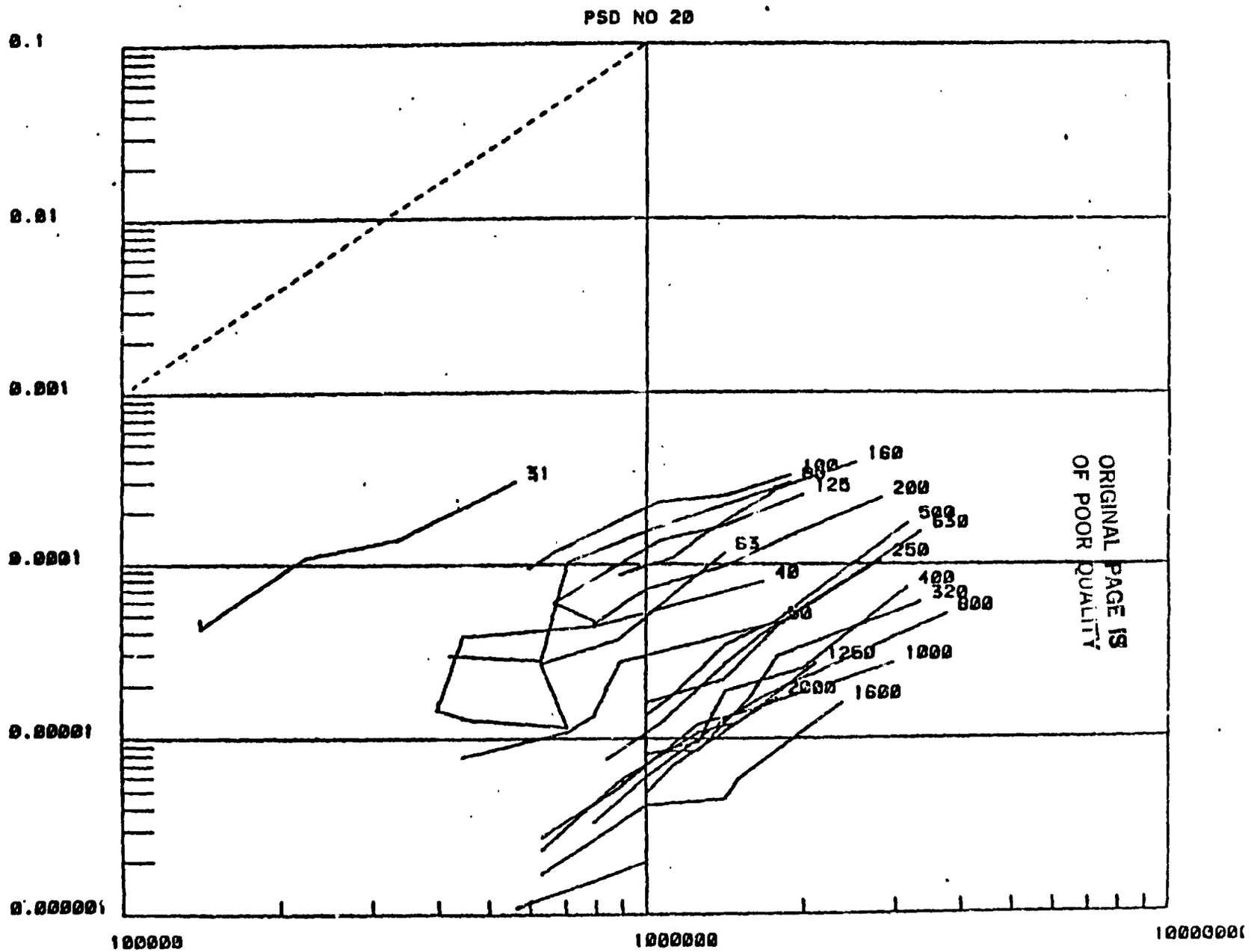


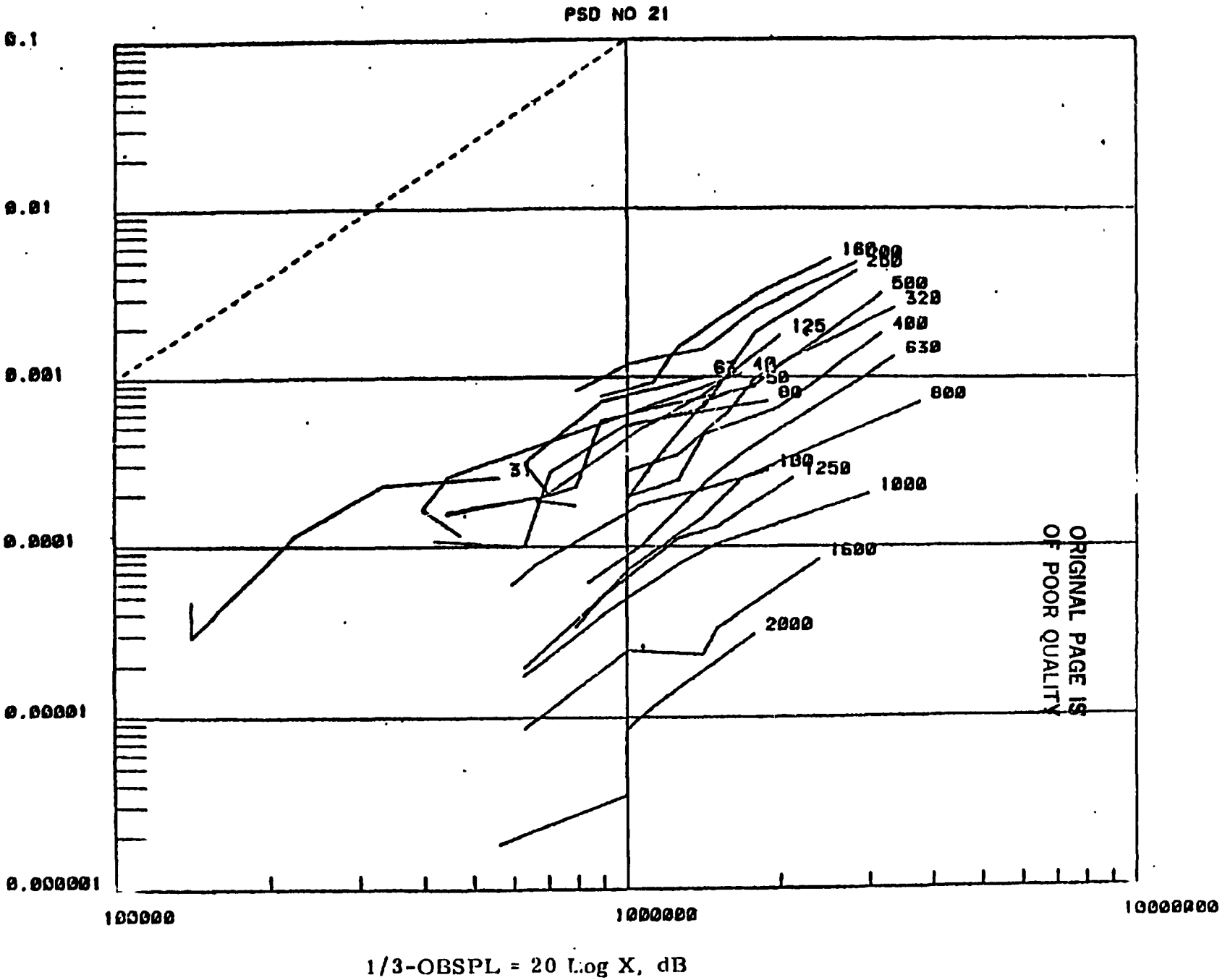
1/3-OB Power Spectral Density, g^2/Hz

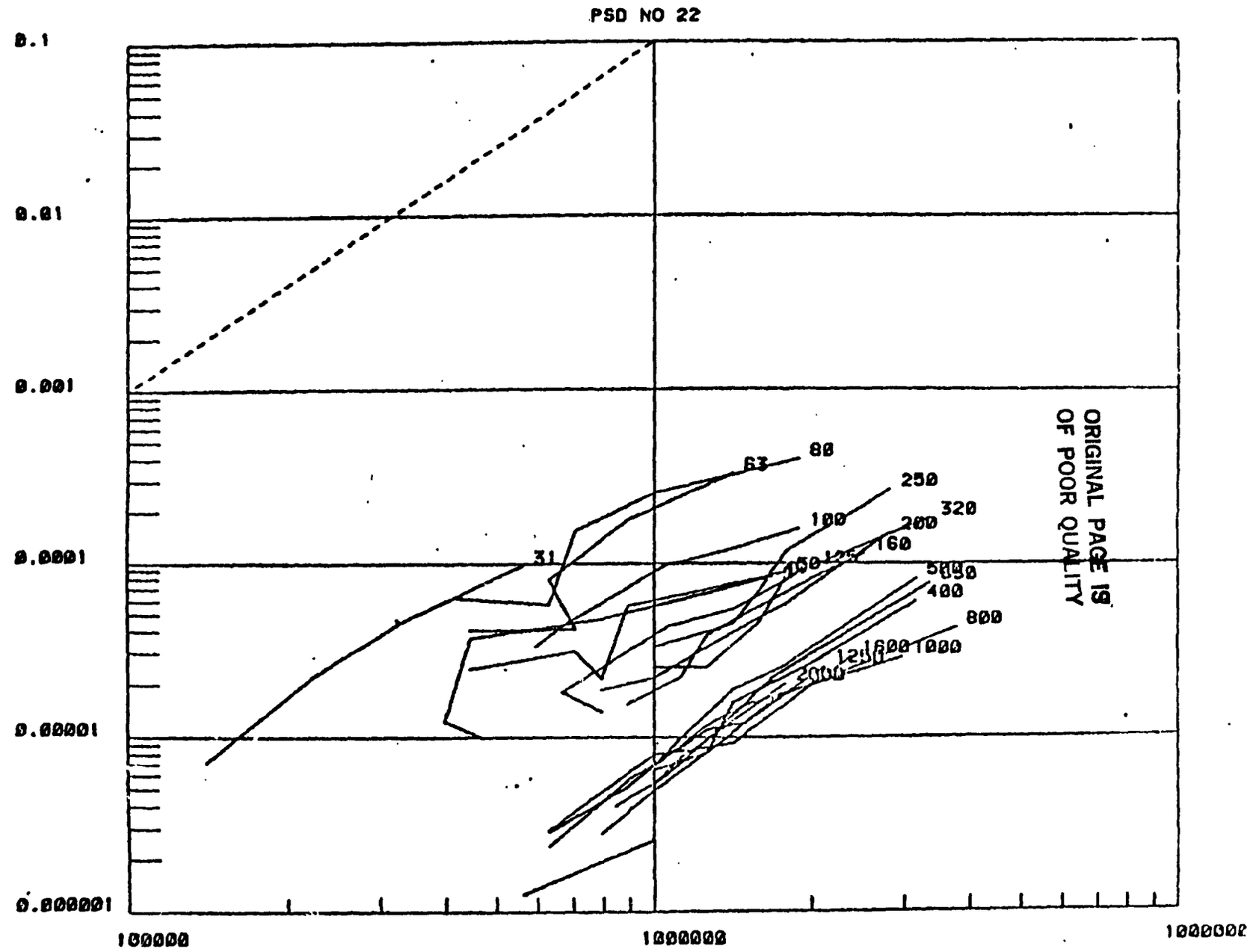
1/3-OBSPL = 20 Log X, dB


PSD NO 144
0.1
0.01
0.001
0.0001
0.00001
0.000001
125
160
100
200
63
80
320
400
500
630
50
800
1000
1250
100000
1000000
10000000
1/3-OB Power Spectral Density, g²/Hz
1/3-OBSPL = 20 Log X, dB
ORIGINAL PAGE IS
OF POOR QUALITY


PSD NO 148
0.1
0.01
0.001
0.0001
0.00001
0.000001
160
200
400
250
500
125
630
800
100
2000
1000
1250
1600
80
63
31
40
50
100000
1000000
10000000
1/3-OBSPL = 20 Log X, dB
1/3-OB Power Spectral Density, g²/Hz


PSD NO 20
0.1
0.01
0.001
0.0001
0.00001
0.000001
100000
1000000
10000000
1/3-OB Power Spectral Density, g²/Hz
1/3-OBSPL = 20 Log X, dB
31
160
100
125
200
500
630
63
250
40
400
320
800
50
1250
1000
2000
1600
ORIGINAL PAGE IS
OF POOR QUALITY


PSD NO 21
0.1
0.01
0.001
0.0001
0.00001
0.000001
100000
1000000
10000000
1/3-OB Power Spectral Density, g²/Hz
1/3-OBSPL = 20 Log X, dB
160
200
500
320
125
400
630
63
40
50
80
800
31
100
1250
1000
1600
2000
ORIGINAL PAGE IS
OF POOR QUALITY



APPENDIX D

Extrapolated Acoustic Test Data

Table D-1

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL LEVEL

DB RE 2 9E-9 GRMS

MEASUREMENT ID V080 9302A

EXTRAPOLATED TEST

			95% CONFIDENCE LIMIT	
HZ	ACOUSTIC TEST	AVERAGE	UPPER	LOWER
31.5	147.5	137.1	148.9	133 4
40.0	145 4	138.5	142.3	134 8
50.0	139.9	138.1	141.9	134 4
63.0	144.8	143.2	147.0	139.5
80.0	141.2	139.0	142.9	135.1
100.0	148.3	146.2	150 1	142 3
125.0	151.4	148.3	152.2	144.4
160.0	147.4	142.4	146 3	138 5
200.0	149.7	144.7	148.6	140 8
250.0	151.2	144 3	148 1	140 5
315.0	151.1	141 9	145.7	138.1
400.0	147 8	136.5	140.3	132 7
500.0	140.9	136.4	140.2	132 6
630.0	154 8	138 3	142.1	134 5
800.0	153.6	138.3	142.1	134.5
1000.0	140.5	136.4	140.2	132.6
1250.0	150.0	133.3	137.1	129.5
1600.0	147.7	130.7	134.5	126 9
2000.0	140.1	131.1	134.9	127.3
OAL	162 5	154.4	158.3	150.6
GRMS	0.4	0.2	0.2	0 1

Table D-2

STS-3 EXTRAPOLATED DATA
OSS-1 PALLET PAYLOAD
1/3-OCTAVE BAND ACCEL LEVEL
DB RE 2.9E-9 GRMS
MEASUREMENT ID V08D 9303A

EXTRAPOLATED TEST

			95% CONFIDENCE LIMIT	
HZ	ACOUSTIC TEST	AVERAGE	UPPER	LOWER
31.5	143.2	132.8	136 6	129.1
40.0	140 7	133.8	137 6	130.1
50.0	138.7	136.9	140 7	133.2
63.0	146.6	145 0	148 8	141.3
80.0	144.1	141 9	145.8	138.0
100.0	145.5	143 4	147.3	139 5
125.0	144.7	141.6	145.5	137.7
160.0	144.1	139.1	143 0	135.2
200.0	147.6	142.6	146 5	138.7
250.0	147.6	140 7	144.5	136 9
315.0	146.4	137.2	141 0	133 4
400 0	149 4	138.1	141 9	134 3
500.0	153.2	139.7	143.5	135.9
630.0	154.6	138 1	141 9	134.3
800.0	149.0	134.5	138.3	130.7
1000 0	148 2	135.1	138.9	131.3
1250.0	149.7	132.2	136.0	128.4
1600.0	149.1	132.1	135.9	128.3
2000.0	146.0	130.0	133.7	126.1
OAL	161.2	152.3	156.1	148.4
GRMS	0.3	0.1	0.2	0.1

Table D-3

STS-3 EXTRAPOLATED DATA
OSS-1 PALLET PAYLOAD
1/3-OCTAVE BAND ACCEL LEVEL
DB RE 2 9E-9 GRMS
MEASUREMENT ID V08D 9294A

EXTRAPOLATED TEST

			95% CONFIDENCE LIMIT	
HZ	ACOUSTIC TEST	AVERAGE	UPPER	LOWER
31.5	150.9	148.5	152.3	144.8
40.0	155.5	148.6	152.4	144.9
50.0	148.1	146.3	150.1	142.6
63.0	155.5	153.9	157.7	150.2
80.0	157.5	155.3	159.2	151.4
100.0	156.1	154.0	157.9	150.1
125.0	157.4	154.3	158.2	150.4
160.0	159.1	154.1	158.0	150.2
200.0	167.4	162.4	166.3	158.5
250.0	160.8	153.9	157.7	150.1
315.0	156.9	147.7	151.5	143.9
400.0	159.6	148.3	152.1	144.5
500.0	164.2	158.7	154.5	146.9
630.0	174.9	158.4	162.2	154.6
800.0	167.4	152.1	155.9	148.3
1000.0	172.5	159.4	163.2	155.6
1250.0	165.9	148.4	152.2	144.6
1600.0	165.9	148.0	152.7	145.1
2000.0	154.5	137.6	141.3	133.7
OAL	178.9	167.5	171.4	163.7
GRMS	2.5	0.7	1.1	0.4

Table D-4

STS-3 EXTRAPOLATED DATA
OSS-1 PALLET PAYLOAD
1/3-OCTAVE BAND ACCEL LEVEL
DB RE 2 0E-0 GRMS
MEASUREMENT ID V080 9295A

EXTRAPOLATED TEST

			95% CONFIDENCE LIMIT	
HZ	ACOUSTIC TEST	AVERAGE	UPPER	LOWER
31 5	152.6	142 2	146 0	138.5
40.0	149 1	142 2	146.0	138.5
50.0	138.6	136.8	140.6	133 1
63.0	149.2	147.6	151 4	143.9
80.0	147.3	145.1	149.0	141.2
100.0	152 3	150 2	154 1	146.3
125.0	165.6	162.5	166.4	158 6
160.0	165.0	160 8	164 7	156 9
200.0	165.5	160.5	164.4	156.6
250.0	164.3	157 4	161 2	153.6
315.0	165.7	156 5	160.3	152.7
400.0	167 4	156 1	159 9	152 3
500.0	172.5	159 0	162 8	155.2
630.0	175.6	159 1	162 9	155 3
800.0	171 1	155.0	158.6	152.0
1000.0	161 6	148.5	152 3	144 7
1250 0	160 6	151.1	154.9	147.3
1600.0	171.3	154 3	158.1	150.5
2000.0	161.5	144.5	148 3	140.7
OAL	180.6	160.2	173.0	165 3
GRMS	3.1	0.0	1 3	0.5

Table D-5

STS-3 EXTRAPOLATED DATA
USS-1 PALLET PAYLOAD
1/3-OCTAVE BAND ACCEL LEVEL
DB RE 2 9E-8 GRMS
MEASUREMENT ID V08D 9292A

EXTRAPOLATED TEST

HZ	ACOUSTIC TEST	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	144.1	133 7	137 5	130.0
40.0	141.9	135 0	138.8	131 3
50.0	139.2	137 4	141.2	133.7
63.0	150.1	148.5	152 3	144 8
80 0	145.9	143 7	147.6	139.8
100.0	146 5	144 4	148 3	140.5
125.0	158.6	155.5	159.4	151 6
160.0	161.2	156.2	160.1	152.3
200.0	163.0	158.6	162 7	154.9
250.0	163.0	157.0	160 0	153.2
315.0	164.0	155.6	159.4	151.0
400 0	173.0	162.6	166 4	158 0
500.0	170.0	165.4	169.2	161.6
630.0	170.6	163.1	166.0	159.3
800.0	170.6	163.3	167 1	159.5
1000.0	170 7	163 6	167 4	159 0
1250.0	170.2	158.7	162.5	154.0
1600.0	170.4	153.4	157 2	149.6
2000 0	165.0	148.0	152 7	145.1
OAL	185.0	171.0	175.6	168.1
GRMS	5 6	1.1	1 0	0 7

Table D-6

STS-3 EXTRAPOLATED DATA
OSS-1 PALLET PAYLOAD
1/3-OCTAVE BAND ACCEL LEVEL
DB RE 2 9E-9 GRMS
MEASUREMENT ID V080 9293A

EXTRAPOLATED TEST

			95% CONFIDENCE LIMIT	
HZ	ACOUSTIC TEST	AVERAGE	UPPER	LOWER
31.5	154.3	143 9	147.7	140.2
40.0	156 4	149 5	153.3	145.8
50 0	155.2	153.4	157.2	149.7
63.0	161 2	159.6	163 4	155 9
80 0	167 1	164.9	168.8	161.0
100.0	170.1	168 0	171.9	164.1
125.0	186.5	183 4	187.3	179.5
160.0	185.2	180.2	184.1	176.3
200.0	181.4	176.4	180.3	172.5
250.0	179 5	172.6	176 4	168.8
315.0	182 3	173.1	176.9	169 3
400.0	182 9	171.6	175 4	167.8
500.0	180.6	167.1	170 9	163.3
630.0	182 1	165 6	169.4	161 8
800.0	181 1	165.8	169.6	162.0
1000.0	176 1	163.0	166.8	159.2
1250.0	172 1	154.6	158.4	150.8
1600.0	160 8	151.8	155.6	148.0
2000.0	164.0	147.9	151.7	144.1
OAL	192 7	186.5	190.4	182 6
GRMS	12.5	6.1	9.6	3.9

Table D-7

STS-3 EXTRAPOLATED DATA
OSS-1 PALLET PAYLOAD
1/3-OCTAVE BAND ACCEL LEVEL
DB RE 2 9E-9 GRMS
MEASUREMENT ID V08D 9297A

EXTRAPOLATED TEST

			95% CONFIDENCE LIMIT	
HZ	ACOUSTIC TEST	AVERAGE	UPPER	LOWER
31.5	141 1	130.7	134 5	127.0
40 0	141 3	134 4	138 2	130 7
50 0	141 6	139.8	143.6	136.1
63 0	148.2	146.6	150.4	142.9
80.0	146.1	143.9	147.8	140.0
100 0	147 1	145 0	148 9	141.1
125.0	151.9	148.8	152.7	144.9
160.0	158.6	153.6	157.5	149.7
200.0	162.8	157.8	161.7	153.9
250.0	159 2	152 3	156 1	148.5
315.0	159.9	150 7	154.5	146 9
400.0	161 3	150.8	153 8	146 2
500 0	162.5	149.0	152 8	145 2
630.0	163 5	147 0	150.8	143 2
800.0	160 1	144.8	148.6	141 0
1000 0	158.1	145.0	148.8	141 2
1250.0	155.9	138.4	142.2	134.6
1600 0	152.2	135.2	139.0	131 4
2000.0	152.0	135.0	139.6	132 0
OAL	171.0	162.1	166.0	158 2
GRMS	1 0	0 4	0.6	0 2

Table D-8

STS-3, EXTRAPOL. , DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL LEVEL

DB RE 2.0E-8 GRMS

MEASUREMENT ID V080 9298A

EXTRAPOLATED TEST

			95% CONFIDENCE LIMIT	
HZ	ACOUSTIC TEST	AVERAGE	UPPER	LOWER
31.5	142 6	132 2	136.8	128 5
40 0	137.2	130.3	134.1	126 6
50.0	139 1	137 3	141.1	133.6
63.0	147 7	146.1	149 9	142.4
80 0	151 8	149.6	153.5	145.7
100.0	150.9	148.8	152.7	144.9
125.0	148.4	145.3	149.2	141.4
160 0	146 1	141 1	145.0	137.2
200.0	145.5	140.5	144 4	136.6
250.0	145.5	138.6	142 4	134 8
315.0	145.7	136.5	140.3	132.7
400 0	152 4	141 1	144 9	137 3
500 0	151 2	137.7	141.5	133.9
630 0	150 1	141 6	145.4	137 8
800 0	150.5	143.2	147.0	139.4
1000.0	150.7	145.6	149.4	141.8
1250.0	162.9	145.4	149.2	141.6
1600.0	162.9	145.9	149.7	142.1
2000.0	154.4	137.4	141.2	133.6
OAL	160.5	156 6	160.4	152.7
GRMS	0.0	0.2	0.3	0 1

Table D-9

OF POOR QUALITY

STS-3 EXTRAPOLATED DATA
OSS-1 PALLET PAYLOAD
1/3-OCTAVE BAND ACCEL LEVEL
DB RE 2 9E-9 GRMS
MEASUREMENT ID V880 9299A

EXTRAPOLATED TEST

			95% CONFIDENCE LIMIT	
HZ	ACOUSTIC TEST	AVERAGE	UPPER	LOWER
31.5	148 2	137 8	141 6	134.1
40 8	148 7	141 8	145.6	138 1
50.8	149 3	147.5	151.3	143.8
63.8	154 1	152 5	156.3	148 8
80.8	162.1	159.9	163.8	156 8
100.8	172 4	170.3	174.2	166.4
125.8	171 2	168.1	172 8	164.2
160.8	178.7	173.7	177.6	169.8
200.8	178.6	173.6	177.5	169.7
250.8	172.5	165 6	169.4	161.8
315.8	176 7	167 5	171 3	163 7
400.8	175.3	164.8	167.8	160 2
500.8	173.6	160 1	163.9	156 3
630.8	174 4	157 9	161 7	154 1
800.8	173.5	158 2	162.8	154.4
1000.8	170 8	157.7	161.5	153.9
1250.8	164 1	146.6	150.4	142.8
1600.8	162.5	145 5	149.3	141.7
2000.8	155.1	160 1	171.9	164.3
OAL	185.6	179 3	183.2	175 4
GRMS	5.6	2.7	4.2	1 7

Table D-10

STS-3 EXTRAPOLATED DATA
OSS-1 PALLET PAYLOAD
1/3-OCTAVE BAND ACCEL LEVEL
DB RE 2.0E-8 GRMS
MEASUREMENT ID V08D 9300A

EXTRAPOLATED TEST

			95% CONFIDENCE LIMIT	
HZ	ACOUSTIC TEST	AVERAGE	UPPER	LOWER
31.5	140.4	130.0	133.8	126.3
40.0	135 9	129.0	132 8	125.3
50.0	135.4	133.6	137 4	129.9
63.0	151 3	149 7	153.5	146 0
80.0	151.2	149 0	152.9	145.1
100.0	153 9	151 8	155.7	147 9
125.0	163 4	160.3	164.2	156.4
160.0	158.2	153.2	157 1	149.3
200.0	156.0	151 9	155.8	148.0
250.0	160.4	153.5	157 3	149.7
315.0	151.9	142.7	146.5	136 9
400 0	151 4	140 1	143 9	136 3
500.0	151 2	137 7	141.5	133.9
630 0	149.5	133.0	136.8	129 2
800 0	149.4	134.1	137.9	130.3
1000.0	149.6	136.5	140.3	132.7
1250.0	149.5	132.0	135.8	128.2
1600.0	150.2	133.2	137.0	129.4
2000.0	149.1	132.1	135.0	128.3
OAL	167 7	163.1	167.0	159.2
GRMS	0.7	0.4	0.6	0.3

Table D-11

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL LEVEL

DB RE 2.9E-9 GRMS

MEASUREMENT ID V080 9301A

EXTRAPOLATED TEST

			95% CONFIDENCE LIMIT	
HZ	ACOUSTIC TEST	AVERAGE	UPPER	LOWER
31.5	141.9	131.5	135.3	127.8
40.0	142 3	135 4	139.2	131.7
50 0	139.9	138.1	141.9	134 4
63.0	145.8	144 2	148.0	140.5
80.0	148.6	146.4	150.3	142.5
100.0	152 5	138.4	154.3	146.5
125.0	161.9	158.8	162 7	154.9
160 0	170.1	165.1	169 0	161.2
200.0	169.6	164.6	168.5	160.7
250.0	168.1	161 2	165.0	157 4
315.0	165.6	156 4	160.2	152 6
400.0	170 9	159 6	163 4	155 8
500.0	170.6	157.1	160 9	153 3
630 0	168 2	151 7	155 5	147 9
800 0	160.5	153.2	157.0	149.4
1000.0	162.6	149.5	153.3	145 7
1250 0	162.5	145.0	148.0	141 2
1600.0	162.2	145.2	149.0	141.4
2000.0	163.1	146.1	149.9	142.3
OAL	170.0	170.3	174 2	166.5
GRMS	2.5	1.0	1 5	0 6

Table D-12

STS-3 EXTRAPOLATED DATA
OSS-1 PALLET PAYLOAD
1/3-OCT BAND ACCEL SPECTRAL DENSITY LEVEL
DB RE 2 9E-9 GRMS
MEASUREMENT ID V080 9302A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	128 5	132.3	124 8
40 8	128.8	132.6	125 1
50 8	127.5	131 3	123 8
63.8	131.6	135.4	127 9
80.8	126.3	130.2	122 4
100 8	132.6	136.5	128 7
125 8	133 7	137 6	129 8
160.8	126.7	130.6	122 8
200.8	128 8	131 9	124.1
250.8	126.7	130.5	122 9
315.8	123.3	127.1	119.5
400.8	116.8	120.6	113 8
500.8	115.8	119.6	112.8
630.8	116 7	120.5	112 9
800.8	115.6	119 4	111.8
1000.8	112 8	116.6	109.8
1250.8	108.7	112.5	104.9
1600 8	105.8	108.8	101 2
2000 8	104.4	108.2	100.6

Table D-13

ORIGINAL PAGE IS OF POOR QUALITY

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL SPECTRAL DENSITY

G2/HZ

MEASUREMENT ID V080 9302A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	6.0E-005	1.4E-004	2.5E-005
40.0	6.4E-005	1.5E-004	2.7E-005
50.0	4.7E-005	1.1E-004	2.0E-005
63.0	1.2E-004	2.9E-004	5.1E-005
80.0	3.6E-005	8.9E-005	1.4E-005
100.0	1.5E-004	3.8E-004	6.2E-005
125.0	2.0E-004	4.9E-004	8.0E-005
160.0	3.9E-005	9.7E-005	1.6E-005
200.0	5.3E-005	1.3E-004	2.1E-005
250.0	3.0E-005	9.4E-005	1.7E-005
315.0	1.8E-005	4.3E-005	7.5E-006
400.0	4.0E-006	9.6E-006	1.7E-006
500.0	3.2E-006	7.6E-006	1.3E-006
630.0	3.9E-006	9.4E-006	1.7E-006
800.0	3.1E-006	7.3E-006	1.3E-006
1000.0	1.6E-006	3.8E-006	6.7E-007
1250.0	6.2E-007	1.5E-006	2.6E-007
1600.0	2.7E-007	6.3E-007	1.1E-007
2000.0	2.3E-007	5.5E-007	9.7E-008

Table D-14

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCT BAND ACCEL SPECTRAL DENSITY LEVEL

DB RE 2.9E-9 GRMS

MEASUREMENT ID V08D 9303A

		95% CONFIDENCE LIMIT	
HZ	AVERAGE	UPPER	LOWER
31.5	124 2	128 8	120.5
40.0	124 1	127.9	120.4
50.0	126.3	130.1	122.6
63.0	133.4	137.2	129 7
80.0	129.2	133.1	125.3
100 0	129 8	133.7	125.9
125.0	127 0	130.9	123.1
160 0	123 4	127.3	119 5
200 0	125.9	129.8	122.0
250.0	123.1	126.9	119 3
315.0	118 6	122.4	114.8
400.0	118.4	122.2	114 6
500 0	119.1	122.9	115.3
630.0	116 5	120 3	112.7
800.0	111.8	115 6	108.0
1000.0	111.5	115.3	107.7
1250.0	107.6	111 4	103.8
1600 0	106.4	110 2	102.6
2000.0	103.2	107.0	99 1

Table D-15

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL SPECTRAL DENSITY

G2/HZ

MEASUREMENT ID V08D 9303A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	2.2E-005	5.2E-005	9.3E-006
40.0	2.2E-005	5.1E-005	9.1E-006
50.0	3.6E-005	8.5E-005	1.5E-005
63.0	1.8E-004	4.4E-004	7.8E-005
80.0	7.0E-005	1.7E-004	2.8E-005
100.0	8.0E-005	2.0E-004	3.2E-005
125.0	4.2E-005	1.0E-004	1.7E-005
160.0	1.8E-005	4.6E-005	7.4E-006
200.0	3.3E-005	8.1E-005	1.3E-005
250.0	1.7E-005	4.1E-005	7.2E-006
315.0	6.1E-006	1.5E-005	2.6E-006
400.0	5.8E-006	1.4E-005	2.4E-006
500.0	6.8E-006	1.6E-005	2.9E-006
630.0	3.8E-006	8.9E-006	1.6E-006
800.0	1.3E-006	3.0E-006	5.3E-007
1000.0	1.2E-006	2.8E-006	5.0E-007
1250.0	4.8E-007	1.2E-006	2.0E-007
1600.0	3.7E-007	8.7E-007	1.5E-007
2000.0	1.8E-007	4.2E-007	7.4E-008

Table D-16

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCT BAND ACCEL SPECTRAL DENSITY LEVEL

DB RE 2.9E-9 GRMS

MEASUREMENT ID V080 9294A

		95% CONFIDENCE LIMIT	
HZ	AVERAGE	UPPER	LOWER
31.5	139 9	143 7	136 2
40.0	138 9	142.7	135 2
50 0	135.7	139 5	132 0
63 0	142.3	146 1	138.6
80 0	142 6	146.5	138.7
100 0	140.4	144 3	136.5
125.0	139.7	143.6	135 8
160.0	138.4	142.3	134 5
200 0	145.7	149.6	141.8
250.0	136.3	140 1	132 5
315.0	129.1	132.9	125.3
400.0	128.6	132.4	124 8
500.0	130 1	133.9	126.3
630.0	136.8	140.6	133 0
800.0	129.4	133 2	125.6
1000 0	135.8	139 6	132.0
1250 0	123.8	127 6	120.0
1600 0	123 2	127 9	118.4
2000 0	118.8	114 6	107.0

Table D-17

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL SPECTRAL DENSITY

G2/HZ

MEASUREMENT ID V080 9294A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	8.2E-004	1.9E-003	3.5E-004
40.0	6.5E-004	1.5E-003	2.8E-004
50.0	3.1E-004	7.4E-004	1.3E-004
63.0	1.4E-003	3.4E-003	6.0E-004
80.0	1.5E-003	3.8E-003	6.2E-004
100.0	9.2E-004	2.3E-003	3.7E-004
125.0	7.8E-004	1.9E-003	3.2E-004
160.0	5.8E-004	1.4E-003	2.3E-004
200.0	3.1E-003	7.7E-003	1.3E-003
250.0	3.6E-004	8.5E-004	1.5E-004
315.0	6.8E-005	1.6E-004	2.9E-005
400.0	6.1E-005	1.5E-004	2.6E-005
500.0	8.6E-005	2.1E-004	3.6E-005
630.0	4.0E-004	9.6E-004	1.7E-004
800.0	7.3E-005	1.7E-004	3.1E-005
1000.0	3.2E-004	7.6E-004	1.3E-004
1250.0	2.0E-005	4.8E-005	8.5E-006
1600.0	1.8E-005	4.2E-005	7.4E-006
2000.0	1.0E-006	2.4E-006	4.2E-007

Table D-18

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCT BAND ACCEL SPECTRAL DENSITY LEVEL

QB RE 2 9E-9 GRMS

MEASUREMENT ID V08D 9295A

		95% CONFIDENCE LIMIT	
HZ	AVERAGE	UPPER	LOWER
31.5	133.6	137.4	129.9
40.0	132.5	136.3	128.8
50.0	126.2	130.0	122.5
63.0	136.0	139.8	132.3
80.0	132.4	136.3	128.5
100.0	136.6	140.5	132.7
125.0	147.9	151.8	144.0
160.0	145.1	149.0	141.2
200.0	143.8	147.7	139.9
250.0	139.8	143.6	136.0
315.0	137.9	141.7	134.1
400.0	136.4	140.2	132.6
500.0	138.4	142.2	134.6
630.0	137.5	141.3	133.7
800.0	133.1	136.9	129.3
1000.0	124.9	128.7	121.1
1250.0	126.5	130.3	122.7
1600.0	128.6	132.4	124.8
2000.0	117.9	121.6	114.0

Table D-19

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL SPECTRAL DENSITY

G2/HZ

MEASUREMENT ID V08D 9295A

		95% CONFIDENCE LIMIT	
HZ	AVERAGE	UPPER	LOWER
31.5	1.9E-004	4.6E-004	8.1E-005
40.0	1.5E-004	3.5E-004	6.3E-005
50.0	6.5E-005	8.3E-005	1.5E-005
63.0	3.3E-004	7.9E-004	1.4E-004
80.0	1.5E-004	3.6E-004	5.9E-005
100.0	3.8E-004	9.5E-004	1.6E-004
125.0	5.2E-003	1.3E-002	2.1E-003
160.0	2.7E-003	6.7E-003	1.1E-003
200.0	2.0E-003	5.0E-003	8.1E-004
250.0	8.0E-004	1.9E-003	3.4E-004
315.0	5.2E-004	1.2E-003	2.2E-004
400.0	3.7E-004	8.7E-004	1.5E-004
500.0	5.8E-004	1.4E-003	2.4E-004
630.0	4.7E-004	1.1E-003	2.0E-004
800.0	1.7E-004	4.1E-004	7.2E-005
1000.0	2.6E-005	6.2E-005	1.1E-005
1250.0	3.8E-005	8.9E-005	1.6E-005
1600.0	8.1E-005	1.9E-004	2.6E-005
2000.0	5.1E-006	1.2E-005	2.1E-006

Table D-20

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCT BAND ACCEL SPECTRAL DENSITY LEVEL

DB RE. 2 ^{2}E-9 GRMS

MEASUREMENT ID V080 9292A

		95% CONFIDENCE LIMIT	
HZ	AVERAGE	UPPER	LOWER
31.5	125.1	128 9	121 4
40.0	125 3	129.1	121.6
50 0	126.8	130 6	123.1
63 0	136.9	140.7	133 2
80.0	131.0	134 9	127 1
100.0	130 6	134 7	126.9
125.0	140 9	144.8	137 0
160.0	140.5	144.4	136.6
200.0	142.1	146.8	138.2
250.0	139 4	143.2	135 6
315 0	137 0	140.8	133.2
400.0	142 9	146.7	139.1
500.0	144.8	148.6	141.0
630.0	141 5	145.3	137.7
800.0	140.6	144.4	136 8
1000 0	140.0	143.0	136 2
1250.0	134.1	137 9	130.3
1600 0	127 7	131.5	123 9
2000 0	122.2	126.0	118.4

Table D-21

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL SPECTRAL DENSITY

G2/HZ

MEASUREMENT ID V08D 9292A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	2.7E-005	6.5E-005	1.1E-005
40.0	2.8E-005	6.8E-005	1.2E-005
50.0	4.0E-005	9.5E-005	1.7E-005
63.0	4.1E-004	9.8E-004	1.7E-004
80.0	1.1E-004	2.6E-004	4.3E-005
100.0	1.0E-004	2.5E-004	4.1E-005
125.0	1.0E-003	2.6E-003	4.2E-004
160.0	9.4E-004	2.3E-003	3.8E-004
200.0	1.4E-003	3.4E-003	5.5E-004
250.0	7.3E-004	1.7E-003	3.1E-004
315.0	4.2E-004	1.0E-003	1.8E-004
400.0	1.6E-003	3.9E-003	6.9E-004
500.0	2.5E-003	6.1E-003	1.1E-003
630.0	1.2E-003	2.8E-003	5.0E-004
800.0	9.7E-004	2.3E-003	4.1E-004
1000.0	8.4E-004	2.0E-003	3.5E-004
1250.0	2.2E-004	5.1E-004	9.1E-005
1600.0	5.0E-005	1.2E-004	2.1E-005
2000.0	1.4E-005	3.3E-005	5.9E-006

Table D-22

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCT BAND ACCEL.SPECTRAL DENSITY LEVEL

DB RE 2 9E-9 GRMS

MEASUREMENT ID V08D 9293A

		95% CONFIDENCE LIMIT	
HZ	AVERAGE	UPPER	LOWER
31 5	135.3	139.1	131 6
40.0	139 0	143.6	136 1
50.0	142.8	146 6	139 1
63.0	148 0	151 8	144 3
80.0	152.2	156.1	148.3
100.0	154.4	158.3	150.5
125.0	160.8	172.7	164.9
160.0	164.5	168.4	160.6
200.0	159.7	163 6	155 8
250 0	155 0	158.8	151.2
315 0	154 5	158.3	150.7
400.0	151 0	155.7	148 1
500.0	146.5	150 3	142.7
630.0	144 0	147 8	140 2
800 0	143.1	146 9	139.3
1000.0	139.4	143 2	135.6
1250.0	130.0	133.0	126.2
1600 0	126 1	129.0	122 3
2000 0	121.2	125 0	117.4

Table D-23

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL SPECTRAL DENSITY

G2/HZ

MEASUREMENT ID V080 9293A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	2.8E-004	6.8E-004	1.2E-004
40.0	8.0E-004	1.9E-003	3.4E-004
50.0	1.6E-003	3.8E-003	6.8E-004
63.0	5.3E-003	1.3E-002	2.2E-003
80.0	1.4E-002	3.5E-002	5.6E-003
100.0	2.3E-002	5.7E-002	9.3E-003
125.0	6.4E-001	1.6E+000	2.6E-001
160.0	2.4E-001	5.9E-001	9.6E-002
200.0	7.8E-002	1.9E-001	3.2E-002
250.0	2.7E-002	6.3E-002	1.1E-002
315.0	2.4E-002	5.6E-002	9.9E-003
400.0	1.3E-002	3.1E-002	5.5E-003
500.0	3.8E-003	8.9E-003	1.6E-003
630.0	2.1E-003	5.0E-003	8.9E-004
800.0	1.7E-003	4.1E-003	7.2E-004
1000.0	7.3E-004	1.7E-003	3.1E-004
1250.0	8.4E-005	2.0E-004	3.5E-005
1600.0	3.4E-005	8.2E-005	1.4E-005
2000.0	1.1E-005	2.6E-005	4.7E-006

Table D-24

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCT BAND ACCEL SP · RAL DENSITY LEVEL

DB RE 2.9E-9 GRMS

MEASUREMENT ID V080 9297A

		95% CONFIDENCE LIMIT	
HZ	AVERAGE	UPPER	LOWER
31.5	122.1	125.9	118.4
40.0	124.7	128.5	121.0
50.0	129.2	133.8	125.5
63.0	135.0	138.8	131.3
80.0	131.2	135.1	127.3
100.0	131.4	135.3	127.5
125.0	134.2	138.1	130.3
160.0	137.9	141.8	134.0
200.0	141.1	145.0	137.2
250.0	134.7	138.5	130.9
315.0	132.1	135.9	128.3
400.0	130.3	134.1	126.5
500.0	128.4	132.2	124.6
630.0	125.4	129.2	121.6
800.0	122.1	125.9	118.3
1000.0	121.4	125.2	117.6
1250.0	113.0	117.6	110.0
1600.0	109.5	113.3	105.7
2000.0	109.1	112.9	105.3

Table D-25

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL SPECTRAL DENSITY

G2/HZ

MEASUREMENT ID V08D 9297A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	1.4E-005	3.2E-005	5.8E-006
40.0	2.5E-005	5.9E-005	1.0E-005
50.0	7.0E-005	1.7E-004	2.9E-005
63.0	2.7E-004	6.3E-004	1.1E-004
80.0	1.1E-004	2.7E-004	4.5E-005
100.0	1.2E-004	2.9E-004	4.7E-005
125.0	2.2E-004	5.5E-004	8.9E-005
160.0	5.2E-004	1.3E-003	2.1E-004
200.0	1.1E-003	2.7E-003	4.4E-004
250.0	2.5E-004	5.9E-004	1.0E-004
315.0	1.4E-004	3.2E-004	5.7E-005
400.0	0.0E-005	2.1E-004	3.8E-005
500.0	5.8E-005	1.4E-004	2.4E-005
630.0	2.0E-005	6.0E-005	1.2E-005
800.0	1.4E-005	3.2E-005	5.7E-006
1000.0	1.2E-005	2.8E-005	4.9E-006
1250.0	2.8E-006	4.8E-006	0.5E-007
1600.0	7.5E-007	1.8E-006	3.1E-007
2000.0	6.0E-007	1.6E-006	2.9E-007

Table D-26

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCT BAND ACCEL SPECTRAL DENSITY LEVEL

DB RE 2 9E-9 GRMS

MEASUREMENT ID V080 9298A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	123 6	127.4	119.9
40.0	120 6	124 4	116 9
50.0	126 7	130 5	123.0
63 0	134 5	138.3	130.8
80 0	136.9	140.8	133 0
100.0	135.2	139.1	131.3
125.0	130.7	134.6	126.8
160.0	125 4	129.3	121.5
200.0	123 8	127.7	119.9
250.0	121.0	124.8	117.2
315.0	117 9	121.7	114.1
400.0	121.4	125.2	117 6
500.0	117.1	120.9	113 3
630.0	120.0	123.8	116 2
800.0	120.5	124.3	116.7
1000.0	122.0	125.8	118 2
1250.0	120.8	124.6	117.0
1600 0	120 2	124 0	116 4
2000 0	110 7	114 5	106.9

Table D-27

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL SPECTRAL DENSITY

G2/HZ

MEASUREMENT ID V080 9298A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31 5	1.9E-005	4.6E-005	8.1E-006
40.0	9.7E-006	2.3E-005	4.1E-006
50 0	3.9E-005	9.3E-005	1 7E-005
63.0	2.4E-004	5.6E-004	1 0E-004
80.0	4.1E-004	1.0E-003	1.7E-004
100.0	2 8E-004	6.9E-004	1 1E-004
125.0	9.9E-005	2.4E-004	4 0E-005
160.0	2.9E-005	7.2E-005	1.2E-005
200.0	2.0E-005	5.0E-005	8.1E-006
250.0	1.1E-005	2.5E-005	4.4E-006
315.0	5.2E-006	1.2E-005	2.2E-006
400.0	1 2E-005	2.0E-005	4.9E-006
500.0	4.3E-006	1.0E-005	1 8E-006
630.0	8.4E-006	2.0E-005	3.5E-006
800.0	9 4E-006	2.2E-005	4.0E-006
1000.0	1.3E-005	3.2E-005	5.6E-006
1250.0	1 0E-005	2.4E-005	4.2E-006
1600.0	8.8E-006	2 1E-005	3.7E-006
2000.0	9 9E-007	2.4E-006	4.1E-007

Table D-28

STS-3 EXTRAPOLATED DATA
OSS-1 PALLET PAYLOAD
1/3-OCT BAND ACCEL SPECTRAL DENSITY LEVEL
DB RE 2 9E-9 GRMS
MEASUREMENT ID V08D 9299A

		95% CONFIDENCE LIMIT	
HZ	AVERAGE	UPPER	LOWER
31.5	129.2	133.0	125.5
40.0	132.1	135.9	128.4
50.0	136.9	140.7	133.2
63.0	140.9	144.7	137.2
80.0	147.2	151.1	143.3
100.0	156.7	160.6	152.8
125.0	153.5	157.4	149.6
160.0	158.0	161.9	154.1
200.0	156.9	160.8	153.0
250.0	148.0	151.8	144.2
315.0	148.9	152.7	145.1
400.0	144.3	148.1	140.5
500.0	139.5	143.3	135.7
630.0	136.3	140.1	132.5
800.0	135.5	139.3	131.7
1000.0	134.1	137.9	130.3
1250.0	122.0	125.8	118.2
1600.0	119.8	123.6	116.0
2000.0	111.4	115.2	107.6

Table D-29

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL SPECTRAL DENSITY

G2/HZ

MEASUREMENT ID V08D 9299A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	7.0E-005	1.7E-004	2.9E-005
40.0	1.4E-004	3.2E-004	5.8E-005
50.0	4.1E-004	9.8E-004	1.7E-004
63.0	1.0E-003	2.5E-003	4.4E-004
80.0	4.4E-003	1.1E-002	1.8E-003
100.0	3.9E-002	9.7E-002	1.6E-002
125.0	1.9E-002	4.7E-002	7.6E-003
160.0	5.3E-002	1.3E-001	2.1E-002
200.0	4.1E-002	1.0E-001	1.7E-002
250.0	5.3E-003	1.3E-002	2.2E-003
315.0	6.5E-003	1.6E-002	2.7E-003
400.0	2.3E-003	5.4E-003	9.5E-004
500.0	7.5E-004	1.8E-003	3.1E-004
630.0	3.6E-004	8.5E-004	1.5E-004
800.0	3.0E-004	7.1E-004	1.3E-004
1000.0	2.2E-004	5.1E-004	9.1E-005
1250.0	1.3E-005	3.2E-005	5.6E-006
1600.0	8.0E-006	1.9E-005	3.4E-006
2000.0	1.2E-006	2.9E-006	4.9E-007

Table D-30

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCT BAND ACCEL SPECTRAL DENSITY LEVEL

DB RE 2.9E-9 GRMS

MEASUREMENT ID V08D 9300A

		95% CONFIDENCE LIMIT	
HZ	AVERAGE	UPPER	LOWER
31.5	121 4	125.2	117 7
40.0	119.3	123 1	115 6
50.0	123.0	126.8	119 3
63 0	138 1	141 9	134 4
80.0	136.3	140 2	132 4
100.0	138.2	142 1	134.3
125.0	145.7	149.6	141.8
160.0	137.5	141.4	133 6
200.0	135.2	139.1	131 3
250 0	135 9	139.7	132 1
315.0	124.1	127 9	120.3
400.0	120 4	124 2	116.6
500.0	117.1	120.9	113.3
630.0	111 4	115 2	107.6
800.0	111.4	115 2	107.6
1000.0	112 9	116 7	109 1
1250 0	107.4	111 2	103.6
1600 0	107.5	111 3	103 7
2000.0	105 4	109 2	101.6

Table D-31

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL SPECTRAL DENSITY

G2/HZ

MEASUREMENT ID V08D 9300A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	1.2E-005	2.8E-005	4.9E-006
40.0	7.2E-006	1.7E-005	3.0E-006
50.0	1.7E-005	4.0E-005	7.1E-006
63.0	5.4E-004	1.3E-003	2.3E-004
80.0	3.6E-004	8.9E-004	1.4E-004
100.0	5.6E-004	1.4E-003	2.2E-004
125.0	3.1E-003	7.7E-003	1.3E-003
160.0	4.7E-004	1.2E-003	1.9E-004
200.0	2.8E-004	6.9E-004	1.1E-004
250.0	3.3E-004	7.8E-004	1.4E-004
315.0	2.2E-005	5.1E-005	9.1E-006
400.0	9.2E-006	2.2E-005	3.9E-006
500.0	4.3E-006	1.0E-005	1.8E-006
630.0	1.2E-006	2.8E-006	4.9E-007
800.0	1.2E-006	2.8E-006	4.9E-007
1000.0	1.6E-006	3.9E-006	6.9E-007
1250.0	4.6E-007	1.1E-006	1.9E-007
1600.0	4.7E-007	1.1E-006	2.0E-007
2000.0	2.0E-007	6.9E-007	1.2E-007

Table D-32

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCT BAND ACCEL SPECTRAL DENSITY LEVEL

DB RE 2 0E-9 GRMS

MEASUREMENT ID V080 9301A

		95% CONFIDENCE LIMIT	
HZ	AVERAGE	UPPER	LOWER
31 5	122.9	126 7	119 2
40.0	125 7	129 5	122.0
50.0	127 5	131 3	123 8
63 0	132 6	136 4	128.9
80 0	133 7	137.6	129.8
100.0	136 8	140 7	132.9
125.0	144 2	148.1	140 3
160 0	149 4	153 3	145 5
200.0	147 9	151.8	144 0
250.0	143 6	147.4	139.8
315.0	137 8	141 6	134 0
400.0	139.9	143 7	136 1
500.0	136 5	140.3	132 7
630.0	130.1	133 9	126 3
800.0	130 5	134.3	126.7
1000.0	125 9	129 7	122.1
1250.0	120 4	124.2	116 6
1600 0	119.5	123.3	115 7
2000.0	119.4	123.2	115 6

Table D-33

STS-3 EXTRAPOLATED DATA

OSS-1 PALLET PAYLOAD

1/3-OCTAVE BAND ACCEL SPECTRAL DENSITY

G2/HZ

MEASUREMENT ID V08D 9301A

HZ	AVERAGE	95% CONFIDENCE LIMIT UPPER	LOWER
31.5	1.6E-005	3.9E-005	6.9E-006
40.0	3.1E-005	7.4E-005	1.3E-005
50.0	4.7E-005	1.1E-004	2.0E-005
63.0	1.5E-004	3.6E-004	6.5E-005
80.0	2.0E-004	4.9E-004	8.0E-005
100.0	4.0E-004	1.0E-003	1.6E-004
125.0	2.2E-003	5.5E-003	8.9E-004
160.0	7.3E-003	1.8E-002	3.0E-003
200.0	5.2E-003	1.3E-002	2.1E-003
250.0	1.0E-003	4.6E-003	8.1E-004
315.0	5.1E-004	1.2E-003	2.1E-004
400.0	8.2E-004	2.0E-003	3.4E-004
500.0	3.9E-004	8.9E-004	1.6E-004
630.0	8.6E-005	2.1E-004	3.6E-005
800.0	9.4E-005	2.2E-004	4.0E-005
1000.0	3.3E-005	7.8E-005	1.4E-005
1250.0	9.2E-006	2.2E-005	3.9E-006
1600.0	7.5E-006	1.8E-005	3.1E-006
2000.0	7.3E-006	1.7E-005	3.1E-006

APPENDIX E

STS-3/OSS-1 Payload Flight Data

(WORST CASE ENVIRONMENTS)

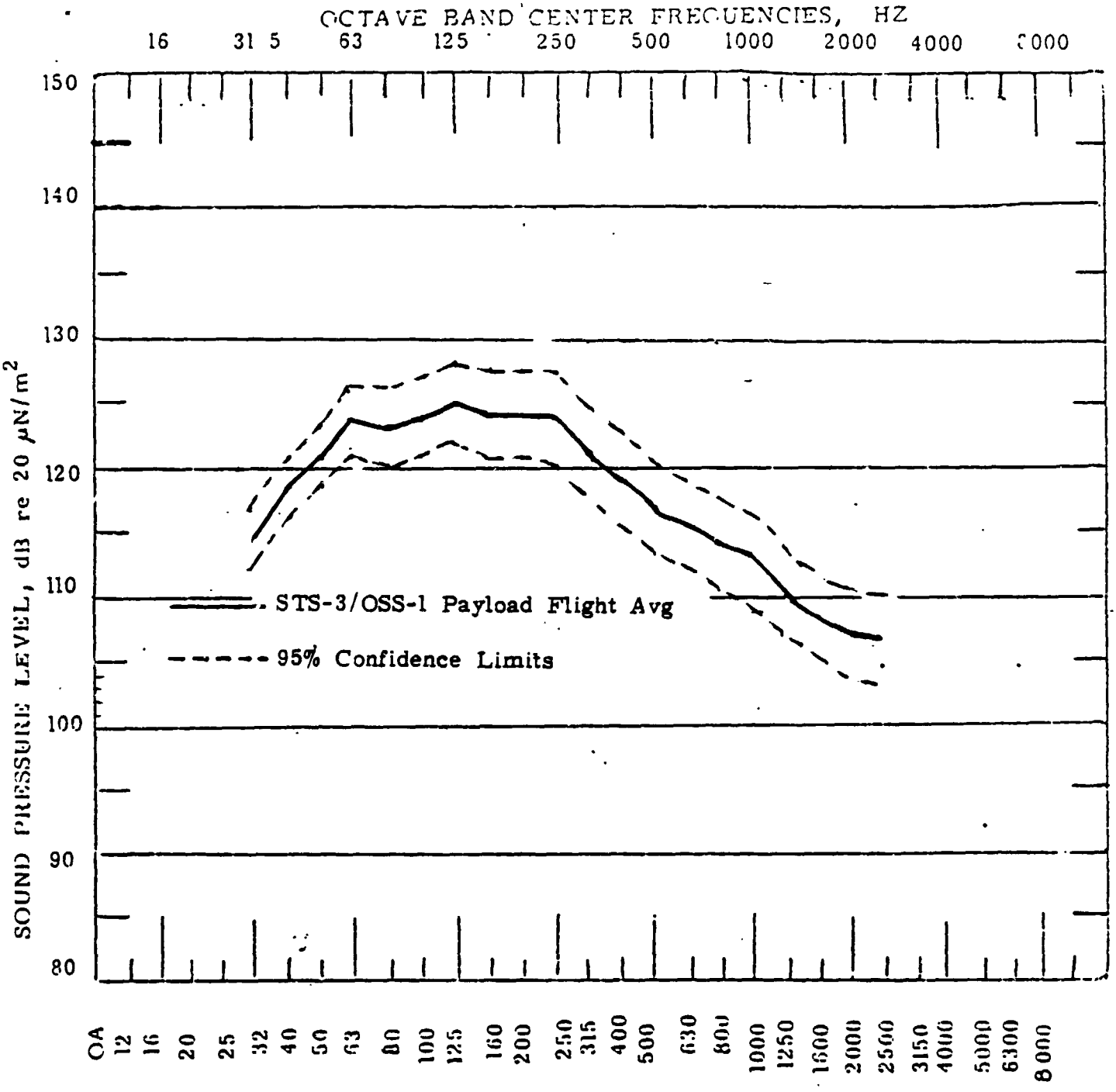
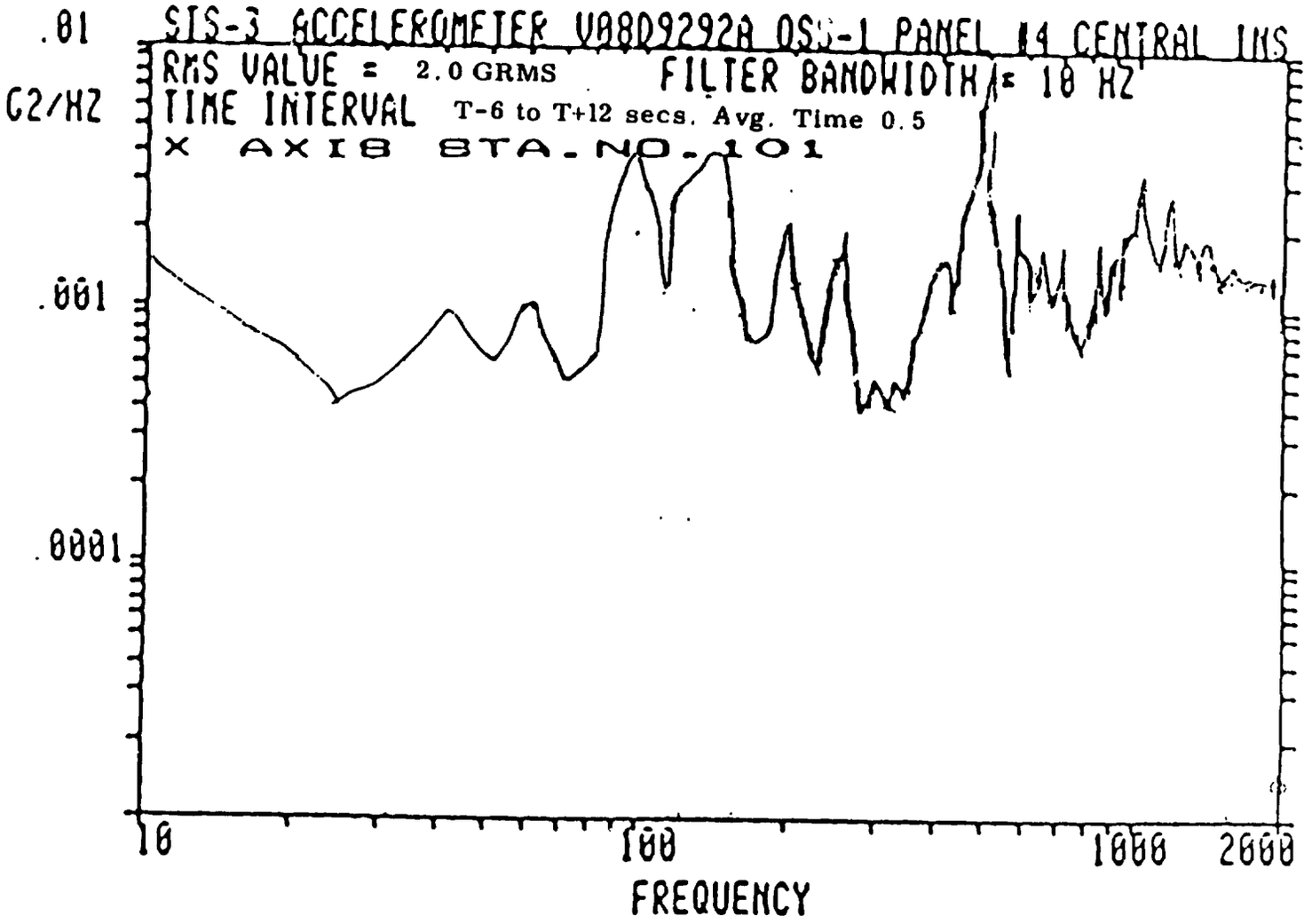


Figure E-1 STS-3/OSS-1 Payload Acoustic Environment
/3-OB Sound Pressure Level in dB

Figure E-2


.01
G2/HZ
.001
.0001
SIS-3 ACCELEROMETER V88D9292A OSS-1 PANEL #4 CENTRAL INS
RMS VALUE = 2.0 GRMS
FILTER BANDWIDTH = 10 HZ
TIME INTERVAL T-6 to T+12 secs. Avg. Time 0.5
X AXIS STA. NO. 101
0
100
1000
2000
FREQUENCY

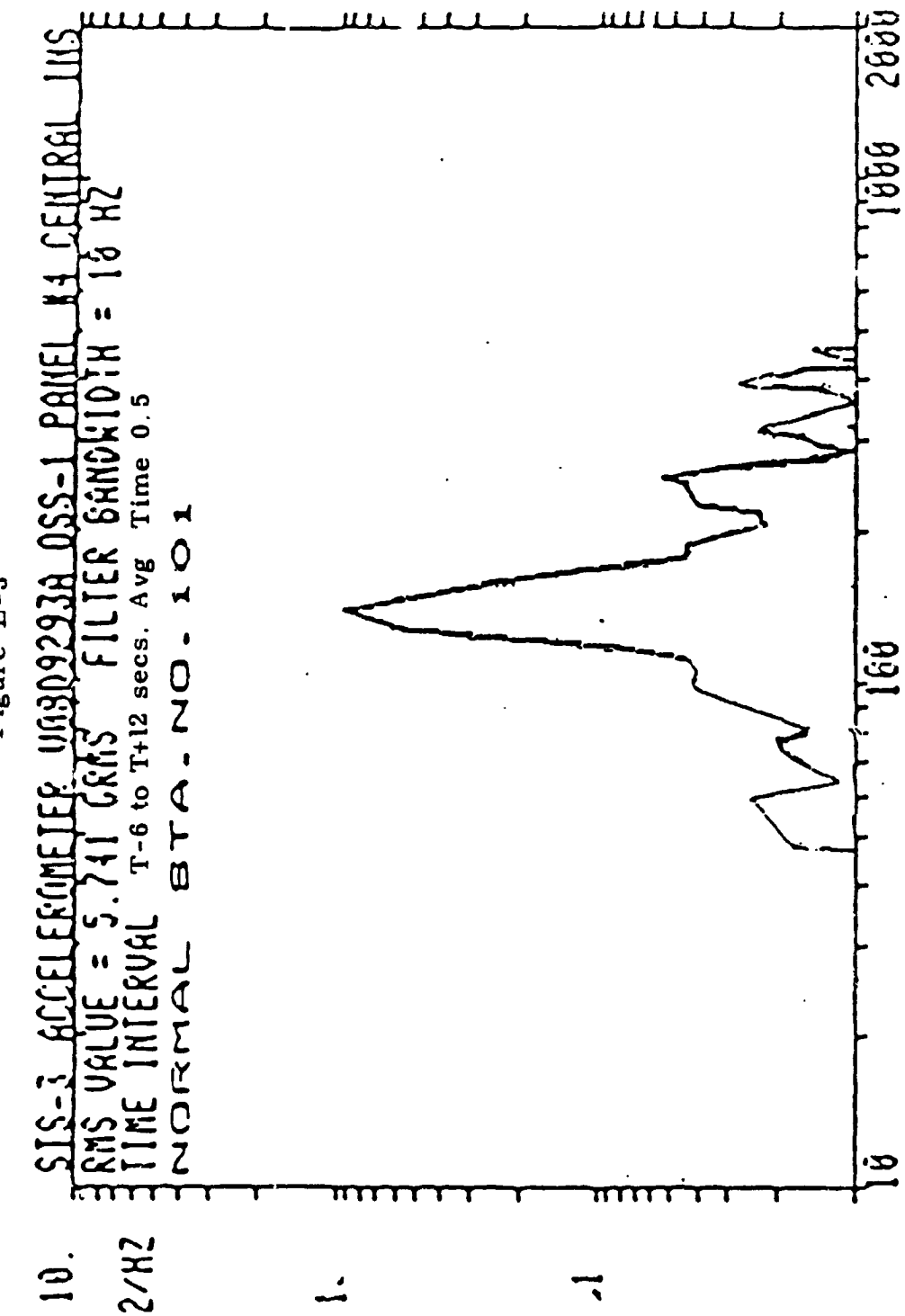
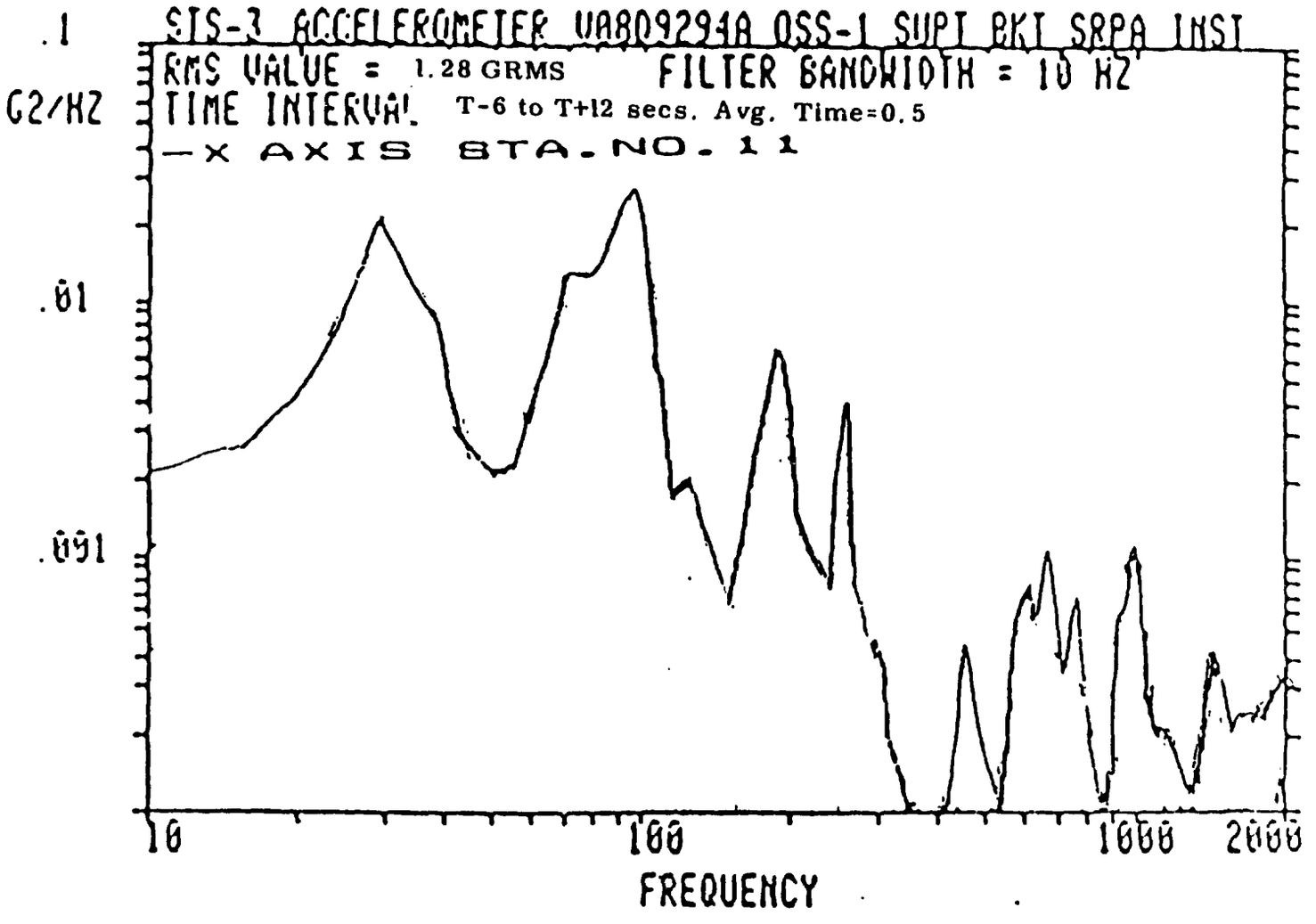


Figure E-3

Figure E-4



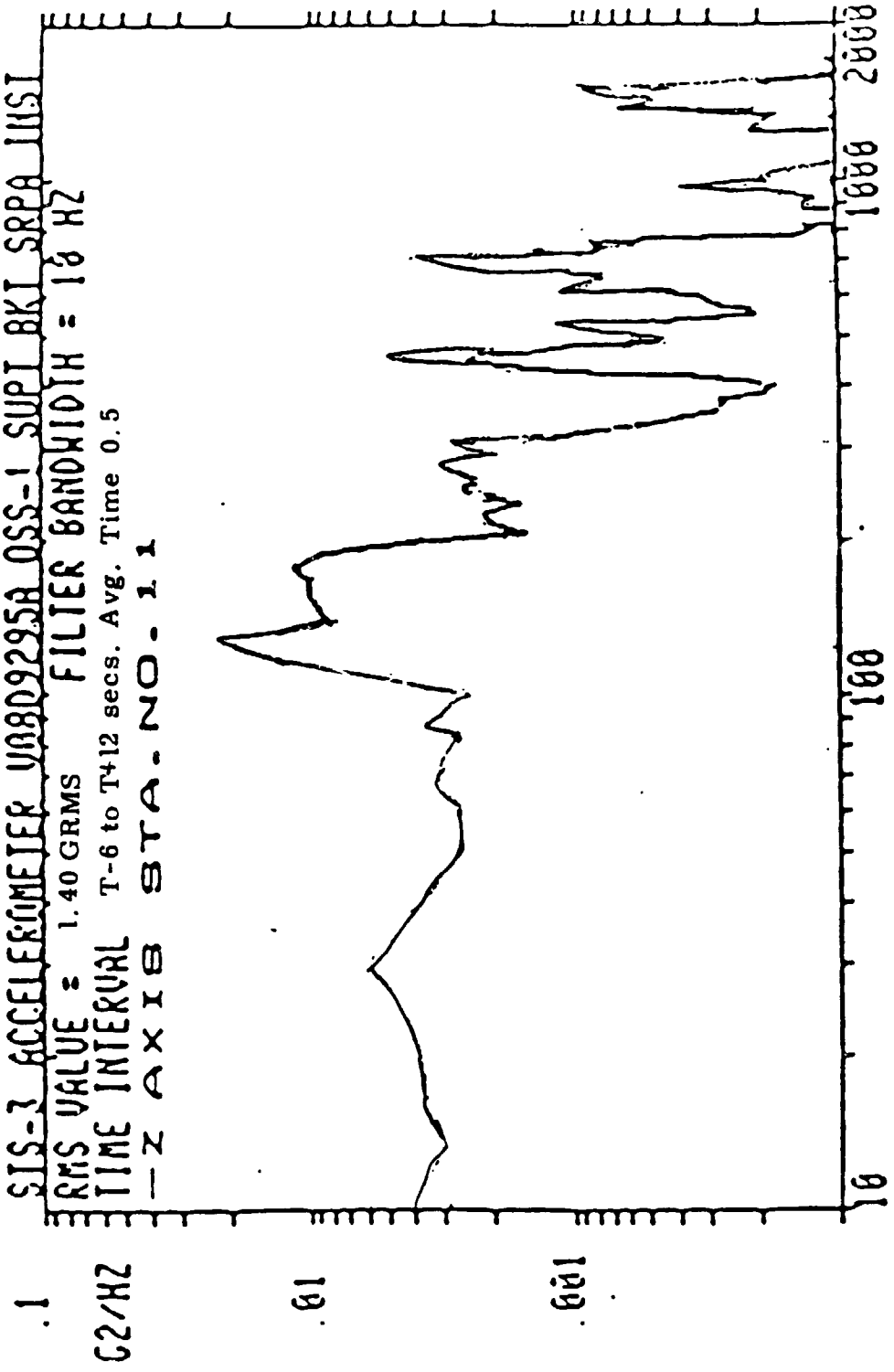


Figure E-5

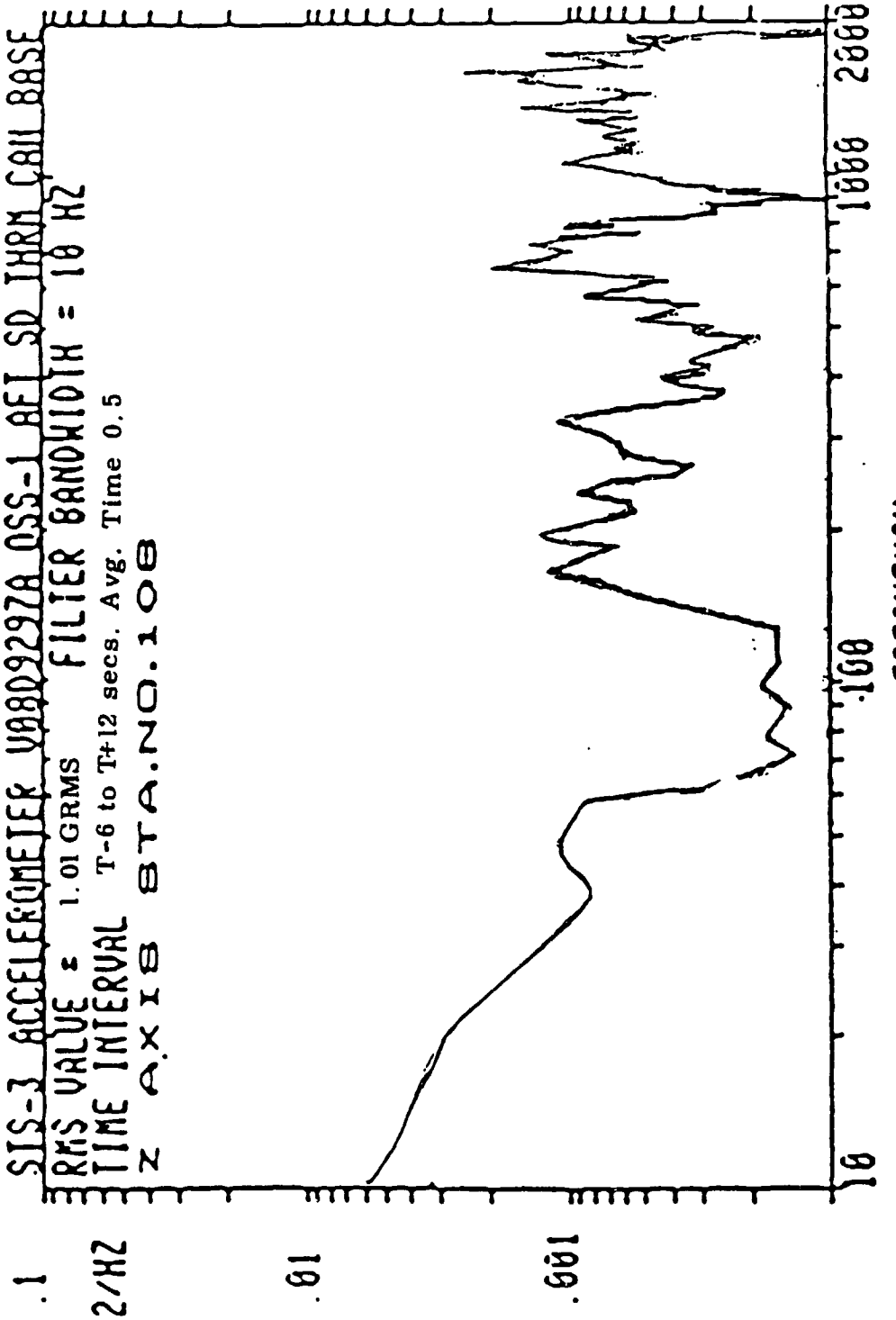


Figure E-6

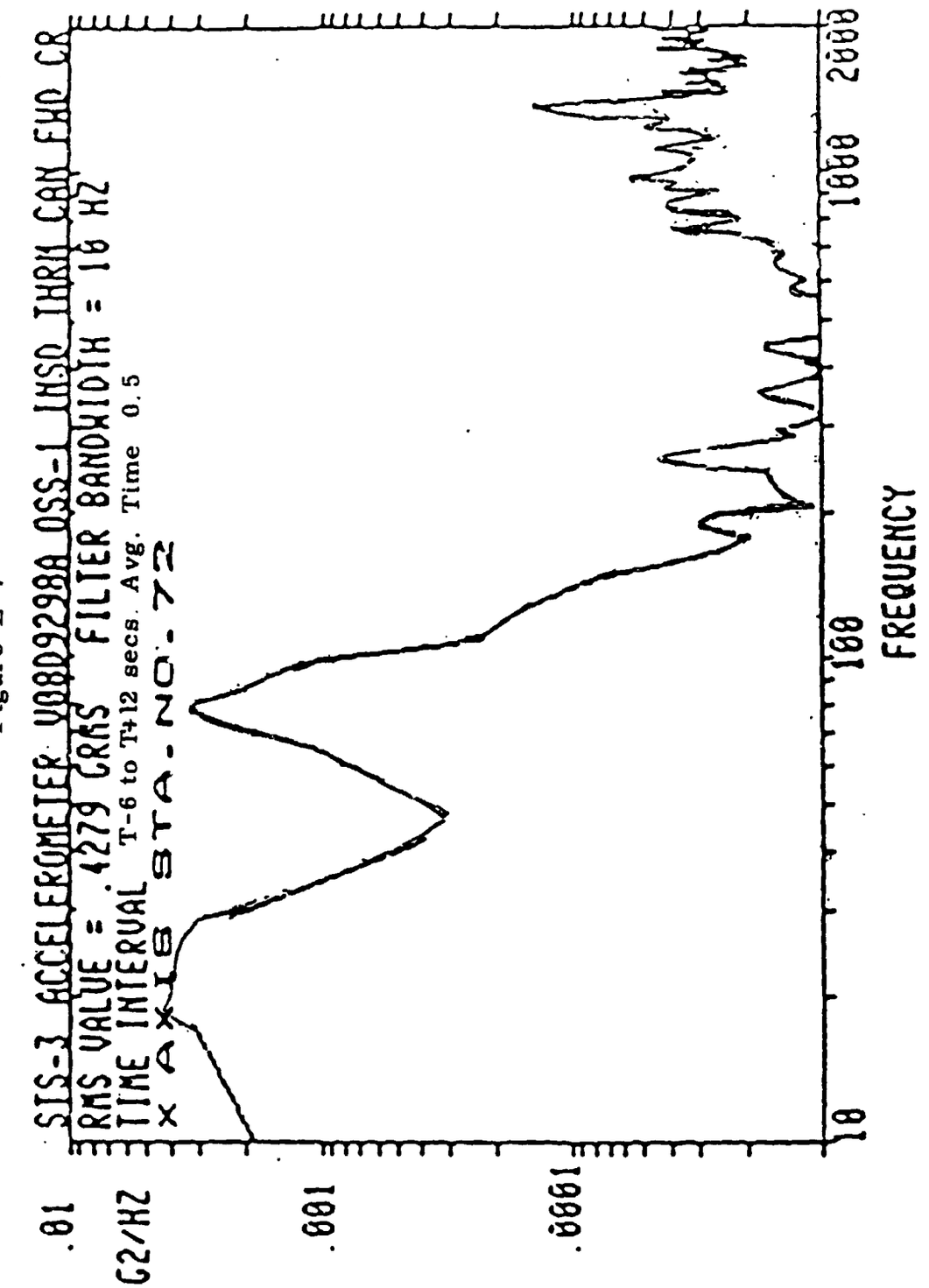


Figure E-7

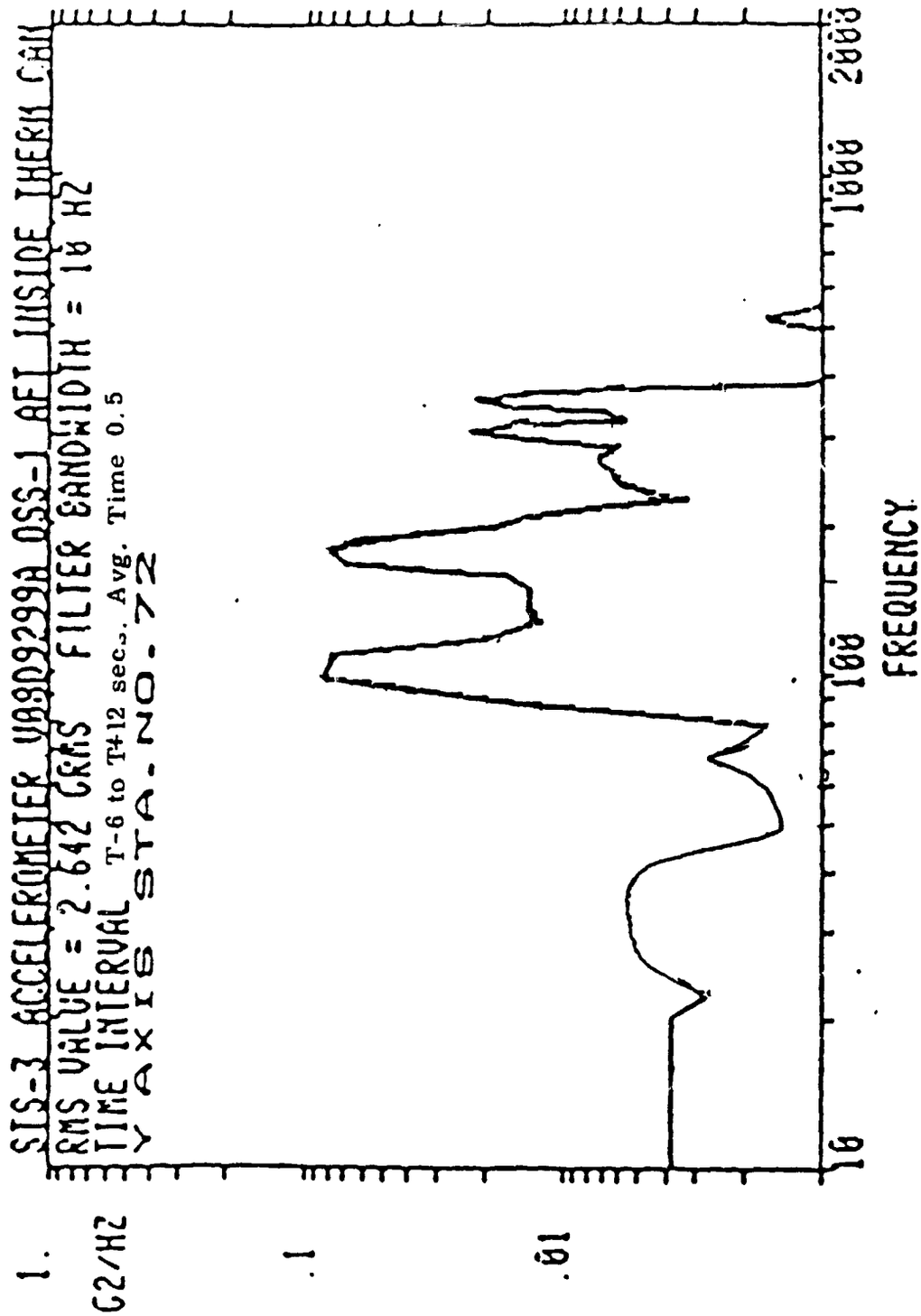


Figure E-8

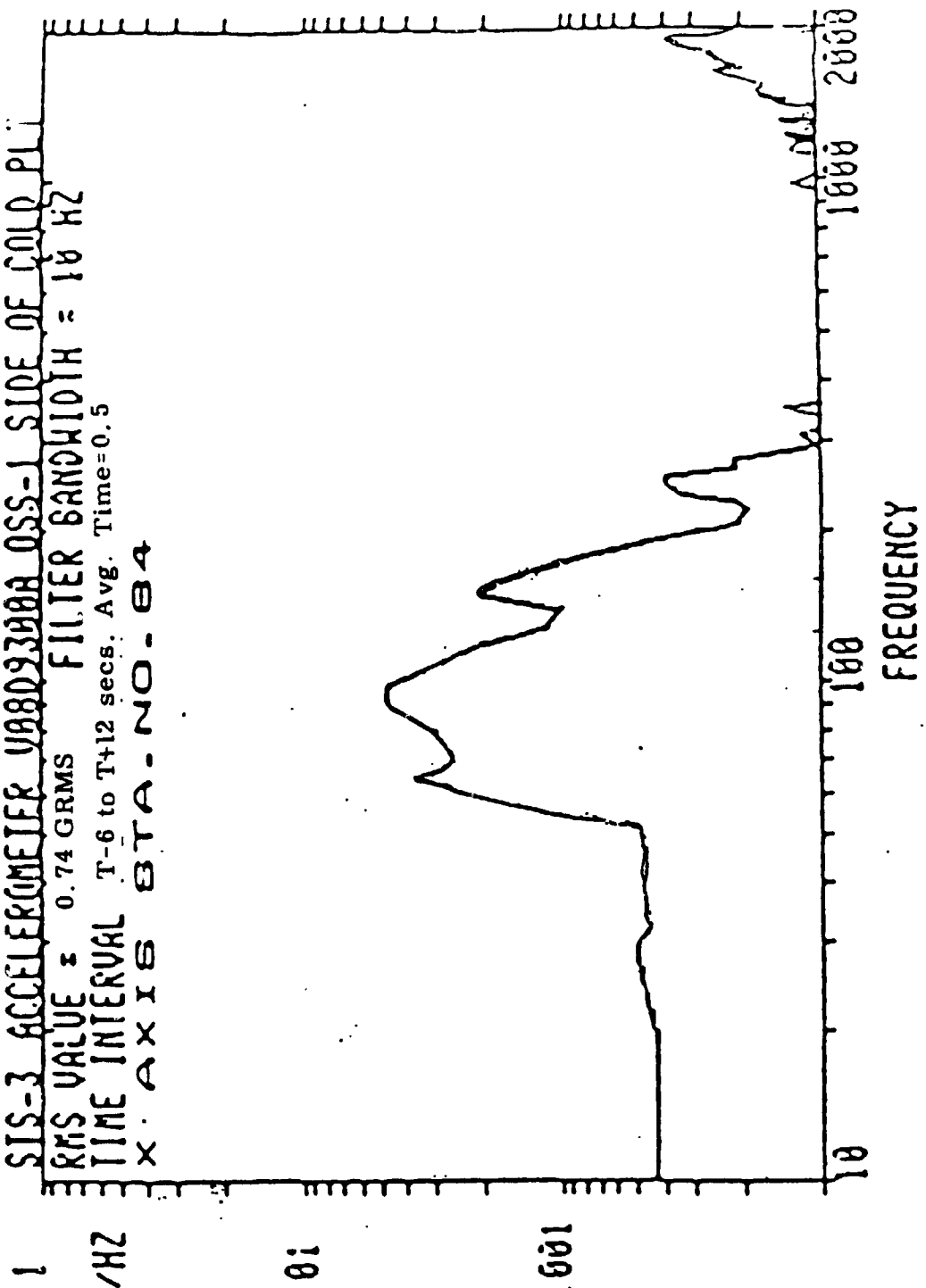


Figure E-9

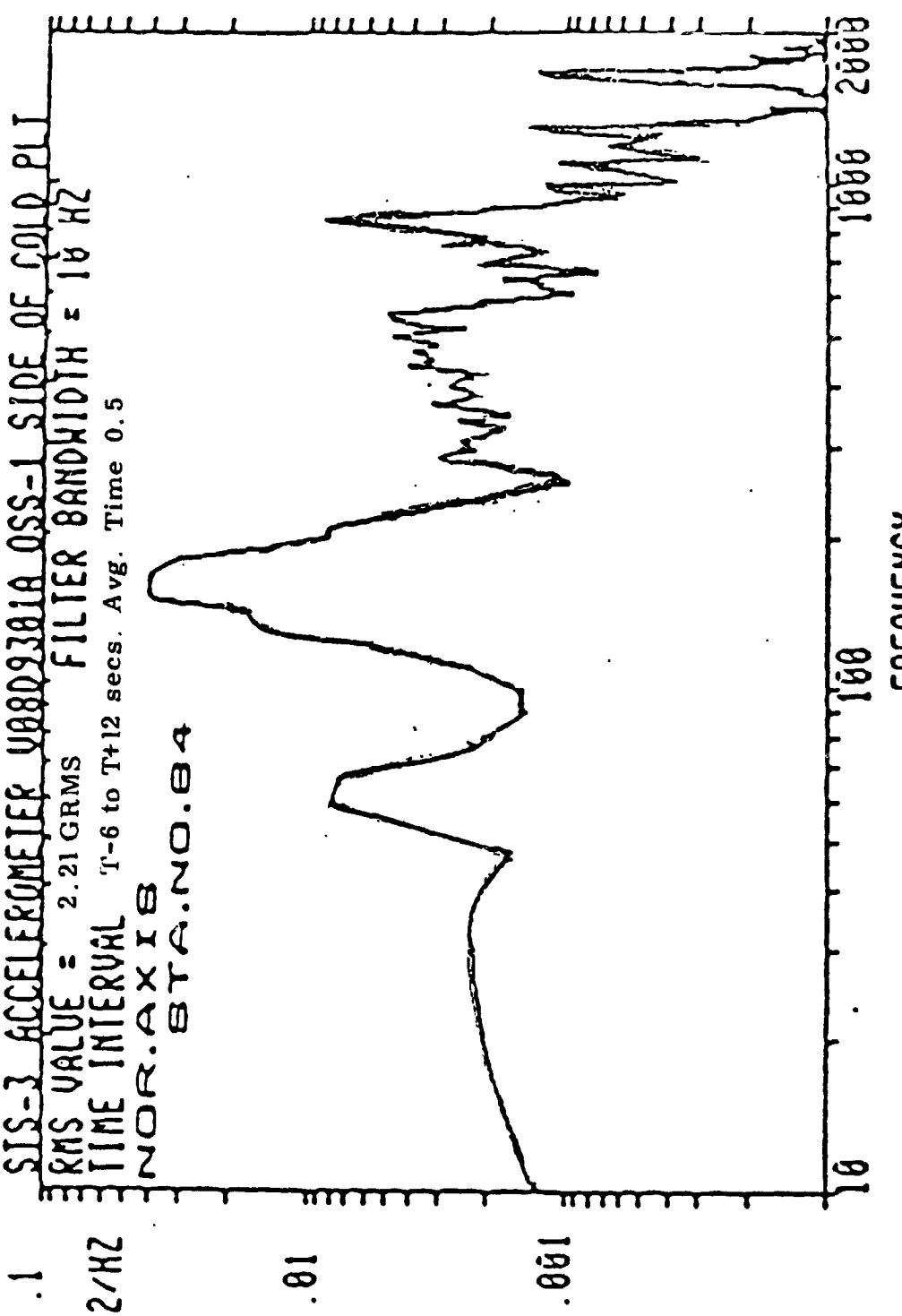


Figure E-10

Figure E-11

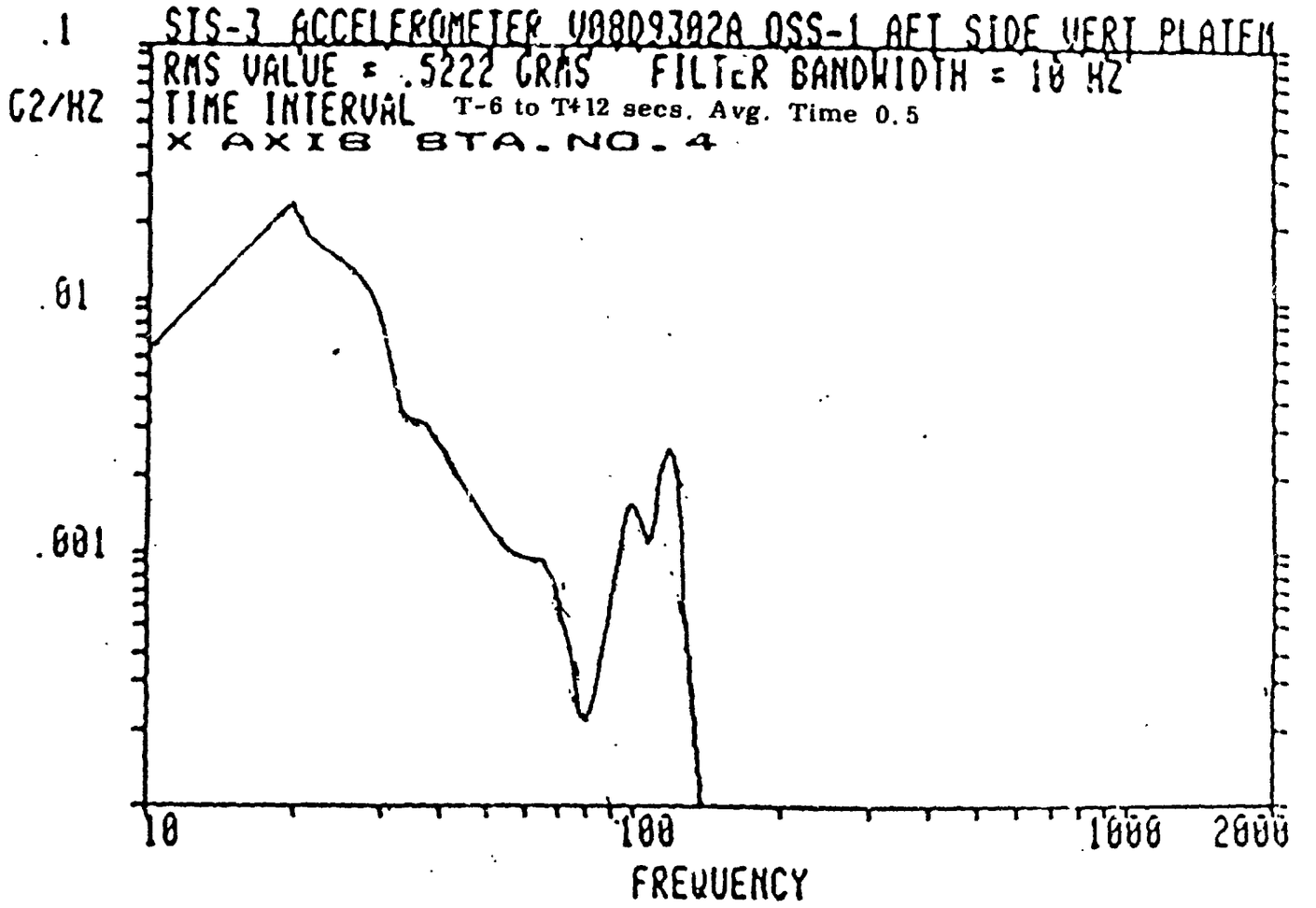


Figure E-12

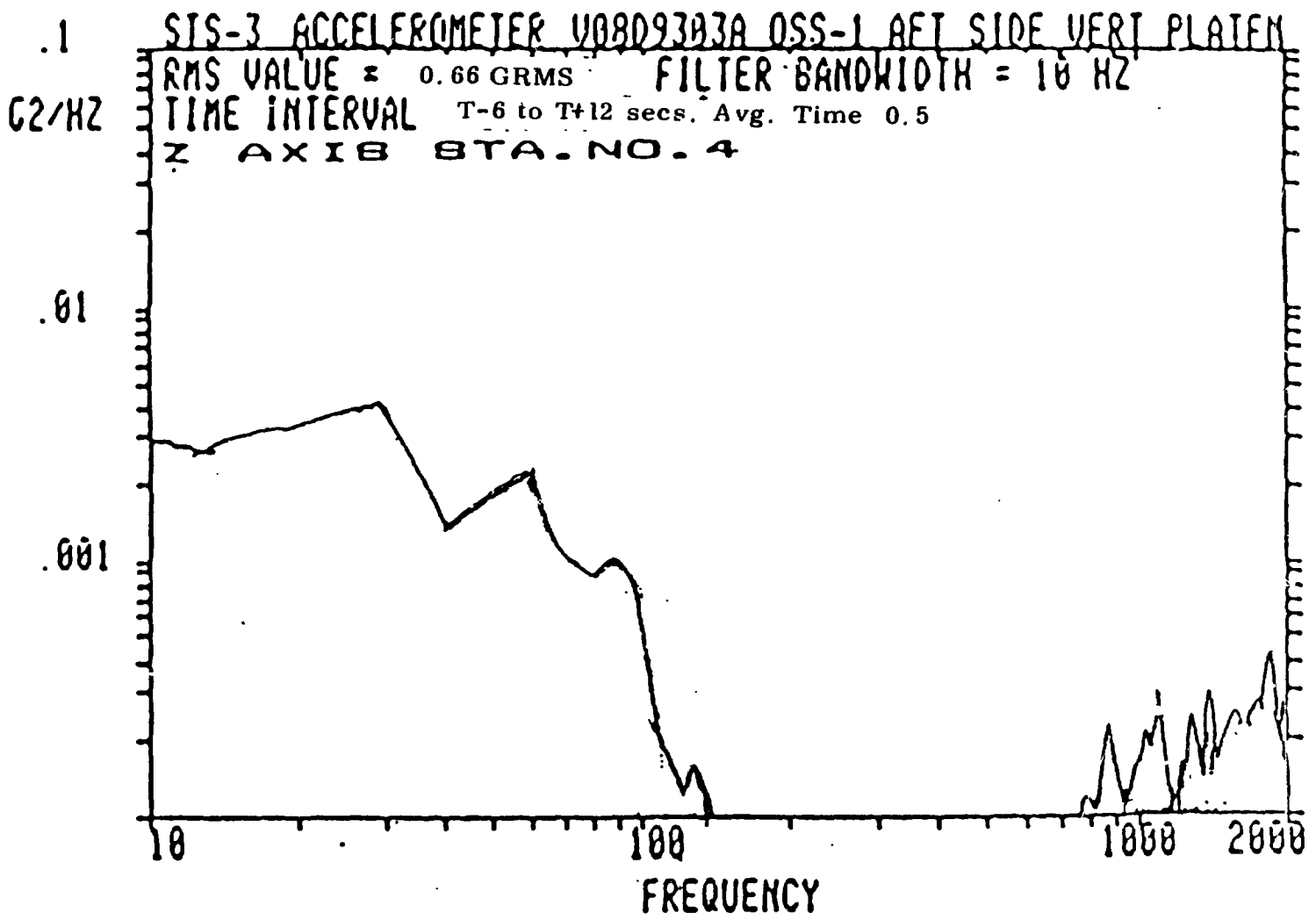


Table E-1- STS-3/OSS-1Payload Flight Data

Measurement ID V03D9292A

HZ	1/3 OBPSDL(DB)	1/3 OBPSD(G**2/HZ)
31 5	138 8	5.3E-004
40 0	140.8	8 4E-004
50.0	139.8	6.7E-004
63 0	140 5	9.4E-004
80 0	139 5	7 5E-004
100 0	146 5	3 0E-003
125 0	145 5	3 0E-003
160 0	144 0	2 1E-003
200 0	142 5	1 5E-003
250 0	142 0	1 3E-003
315 0	138.0	5 3E-004
400.0	144.5	1 2E-003
500 0	147 0	4 2E-003
630 0	143 0	1 7E-003
800 0	142 0	1 3E-003
1000 0	144 0	2 1E-003
1250 0	143 5	1 9E-003
1600 0	143 0	1.7E-003
2000 0	143.0	1 7E-003

Measurement ID V08D9293A

HZ	1/3 OBPSDL(DB)	1/3 OBPSD(G**2/HZ)
31 5		
40.0		
50.0	153 2	1 0E-002
63.0	153 2	1 0E-002
80.0	153 2	1 0E-002
100 0	156 0	3 3E-002
125.0	165 0	2 7E-001
160 0	164 0	2 1E-001
200 0	155 7	3 1E-002
250 0	156 7	3 9E-002
315.0	152 2	1 4E-002
400 0	152 2	1 4E-002
500.0		
630 0		
800 0		
1000 0		
1250 0		
1600 0		
2000 0		

* dB re 2.9×10^{-9} grms

Table F-2- STS-3/OSS-1Payload Flight Data

Measurement ID V08D9294A			Measurement ID V08D9295A		
HZ	1/3 OBSPSDL(DB)	1/3 OBPSD(G*2/HZ)	HZ	1/3 OBPSDL(DB)	1/3 OBPSD(G*2/HZ)
31.5	161.0	1.3E-002	31.5	148.0	5.3E-003
40.0	147.0	4.2E-003	40.0	146.5	3.0E-003
50.0	144.5	2.4E-003	50.0	145.5	3.0E-003
63.0	140.0	6.7E-003	63.0	145.5	3.0E-003
80.0	152.0	1.3E-002	80.0	145.5	3.0E-003
100.0	152.0	1.3E-002	100.0	141.0	1.1E-003
125.0	142.0	1.3E-003	125.0	152.0	1.3E-002
160.0	142.0	1.3E-003	160.0	151.0	1.1E-002
200.0	145.0	2.7E-003	200.0	148.0	5.3E-003
250.0	142.0	1.3E-003	250.0	144.0	2.1E-003
315.0	134.0	2.1E-004	315.0	143.0	1.7E-003
400.0			400.0	133.0	3.3E-004
500.0	133.0	1.7E-004	500.0	142.0	1.3E-003
630.0	139.0	6.7E-004	630.0	138.0	5.3E-004
800.0	134.0	2.1E-004	800.0	137.0	4.2E-004
1000.0	137.0	4.2E-004	1000.0	133.0	1.7E-004
1250.0	133.0	1.7E-004	1250.0		
1600.0	137.0	2.7E-004	1600.0	134.0	2.1E-004
2000.0	135.0	2.7E-004	2000.0		

* dB re 2.9 x 10^{-9} grms

Table E-3- STS-3/OSS-1Payload Flight Data

Measurement ID V08D9297A

HZ	1/3 OBPSDL(DB)	1/3 OBPSD(G*2/HZ)
31.5	141.8	1.1E-003
40.0	140.5	9.4E-004
50.0	140.5	9.4E-004
63.0	136.0	3.3E-004
80.0	132.5	1.7E-004
100.0	132.5	1.5E-004
125.0	133.0	1.7E-004
160.0	130.0	6.7E-004
200.0	130.5	7.5E-004
250.0	130.5	6.8E-004
315.0	130.2	6.7E-004
400.0	130.5	9.4E-005
500.0	130.5	9.4E-005
630.0	140.0	8.4E-004
800.0	130.0	5.3E-004
1000.0	137.0	4.2E-004
1250.0	130.0	6.7E-004
1600.0	140.0	8.4E-004
2000.0		

Measurement ID V08D9298A

HZ	1/3 OBPSDL(DB)	1/3 OBPSD(G*2/HZ)
31.5	142.5	1.5E-003
40.0	138.0	5.3E-004
50.0	137.0	4.2E-004
63.0	141.0	1.1E-003
80.0	145.0	2.7E-003
100.0	139.0	6.7E-004
125.0	133.0	1.7E-004
160.0	126.0	3.3E-005
200.0	123.0	1.7E-005
250.0	124.0	2.1E-005
315.0	121.0	1.1E-005
400.0	121.0	1.1E-005
500.0		
630.0	121.0	1.1E-005
800.0	126.0	3.3E-005
1000.0	127.0	4.2E-005
1250.0	128.0	5.3E-005
1600.0	125.0	2.7E-005
2000.0	125.0	2.7E-005

* dB re 2.0×10^{-9} grms

Table E-4- STS-3/OSS-1Payload Flight Data

Measurement ID V08D9299A

HZ	1/3 OBPSDL(DB)	1/3 OBPSD(G*2/HZ)
31.5	148.8	5.3E-003
40.0	147.8	4.2E-003
50.0	143.8	1.7E-003
63.0	144.8	2.1E-003
80.0	147.8	4.2E-003
100.0	150.8	6.7E-002
125.0	153.8	1.7E-002
160.0	156.8	3.3E-002
200.0	155.8	2.7E-002
250.0	149.8	6.7E-003
315.0	152.8	1.3E-002
400.0		
500.0		
630.0		
800.0		
1000.0		
1250.0		
1600.0		
2000.0		

Measurement ID V08D9300A

HZ	1/3 OBPSDL(DB)	1/3 OBPSD(G*2/HZ)
31.5	137.5	4.7E-004
40.0	137.5	4.7E-004
50.0	138.0	5.3E-004
63.0	144.5	2.4E-003
80.0	146.8	3.3E-003
100.0	147.0	4.2E-003
125.0	142.5	1.5E-003
160.0	142.5	1.5E-003
200.0	136.5	3.0E-004
250.0	135.0	2.7E-004
315.0	131.9	1.1E-004
400.0		
500.0		
630.0		
800.0		
1000.0	130.0	6.4E-005
1250.0	131.0	1.1E-004
1600.0	133.0	1.7E-004
2000.0	134.0	2.1E-004

* dB re 2.9×10^{-9} grms

Table E-5- STS-3/OSS-1Payload Flight Data

Measurement ID V08D9301A

HZ	1/3 OBPSDL (DB)	1/3 OBPSD(G*2/HZ)
31 5	144.5	2.4E-003
40.0	143.5	1.9E-003
50 0	146 0	3.3E-003
63.0	149.0	6.7E-003
80.0	144.0	2.1E-003
100 0	143.5	1.9E-003
125 0	151 0	1 1E-002
160 0	155 5	3.9E-002
200.0	151 5	1 2E-002
250 0	143 5	1 9E-003
315 0	145 0	2.7E-003
400 0	145 0	2 7E-003
500.0	147 0	4.2E-00?
630.0	143 5	1.9E-003
800.0	146 0	3 3E-003
1000.0	140.0	0 4E-004
1250 0	138 0	5 3E-004
1600 0	135.0	2 7E-004
2000 0		

Measurement ID V08D9302A

HZ	1/3 OBPSDL (DB)	1/3 OBPSD(G*2/HZ)
31 5	147.0	4 2E-003
40.0	144 0	2 1E-003
50.0	142.0	1 3E-003
63 0	140 0	0 4E-004
80.0	137 0	4 2E-004
100.0	142.0	1 3E-003
125.0	136 0	3 3E-004
160.0		
200.0		
250 0		
315.0		
400 0		
500 0		
630 0		
800 0		
1000.0		
1250.0		
1600.0		
2000.0		

* dB re 2.9×10^{-9} grms